

# POPULAR SCIENCE



M O N T H L Y

Mechanics & Handicraft

MAY  
15¢

'Chutes Trap  
War Planes

SEE PAGE III





## Read how this new kind of spark plug peps up lazy, spark-weary motors

"IT'S amazing, the difference in the way my car runs since I put in those new Auto-Lite Spark Plugs!" That's what owners of all makes of cars are saying as increasing thousands change to this sensational new kind of spark plug.

Often this one simple change holds the secret of quick, sure starting for sluggish motors—of flashing pickup and power—of smooth, even engine performance at all speeds—of substantial savings due to elimination of gas waste.

The performance of any car depends upon the efficiency of its ignition system. And Auto-Lite Spark Plugs have been expressly developed by ignition engineers to increase the efficiency of the ignition system by working in balanced harmony with it. They fire with less electrical strain—and that means a smooth, uniform flow of power, with faster pickup and livelier engine performance.

Next time you see the Auto-Lite sign, why not stop for a free inspection of your spark plugs? Cleaning and proper setting of the electrodes costs only a few cents; and you will save money by replacing worn-out plugs with new Auto-Lites—they cost no more.



### LISTENING TO AN ENGINE'S HEART-BEAT

Using a sensitive stethoscope, Auto-Lite engineers test the performance of Auto-Lite Spark Plugs under actual operating conditions. No guess work here.

**THE ELECTRIC AUTO-LITE COMPANY**

*Merchandising Division*

TOLEDO, OHIO

SARNIA, ONTARIO

**A TAXI DRIVER TELLS HOW HE PUT  
NEW LIFE INTO HIS SLUGGISH CAR**



"YE'RE HOLDIN' UP TRAFFIC," the cop sez. "Get that jaloppy off the road!" I step on the gas but nothing happens. The old bus acts like she's glued to the spot.



"THIS BUS IS READY TO JUNK," I beef to the service guy. "Put in Auto-Lite Spark Plugs," he says. "She'll take your hat off when you give her the gas."



"HI, PAL!" I yells, next time I pass that cop. His eyes nearly pop out at how the old car shoots ahead with new Auto-Lites on the job.

**IGNITION ENGINEERED  
BY IGNITION ENGINEERS**



Change to **AUTO-LITE SPARK PLUGS**



# Best Features, Best Ride —*Best Buy* of "All Three"

NOW SEE WHAT EACH  
LOW-PRICED CAR GIVES  
FOR YOUR MONEY

1. See the 1940 Quality Chart to discover what each of "All Three" low-priced cars gives you in size, luxury, economy, comfort—in *fine-car* engineering.
2. Take Plymouth's Luxury Ride...you'll realize what extra quality means to you.



YOU'LL BENEFIT FROM THIS  
"ONE-TWO" COMPARISON

1. SEE THE  
QUALITY CHART
2. TAKE THE  
LUXURY RIDE

OF 22 IMPORTANT FEATURES FOUND IN HIGH-PRICED CARS—

*Plymouth has 21... Car "2" has 11... Car "3" has 8*

CAR VALUE *can* be measured! In "One-Two" order you can compare size, features, comfort.

You'll find that Plymouth alone, of "All 3" *low-priced* cars, gives you a majority of the 22 big features found in *high-priced* cars.

See the 1940 Quality Chart at your Plymouth dealer's. Then take Plymouth's Luxury Ride. Plymouth is *easy to buy!* Plymouth Division of Chrysler Corporation.

SEE THE NEW LOW-PRICED 1940 PLYMOUTH COMMERCIAL CARS!

COUPES START AT	SEDANS START AT
<b>\$645</b>	<b>\$699</b>

—DELIVERED IN DETROIT, MICH., including all standard equipment. Prices include all federal taxes. Transportation, state, local taxes, if any, are not included.

## PLYMOUTH BUILDS GREAT CARS



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GEORGE H. WALTZ, Jr., Associate Editor

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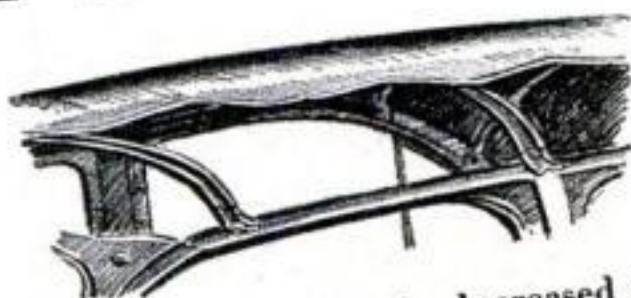
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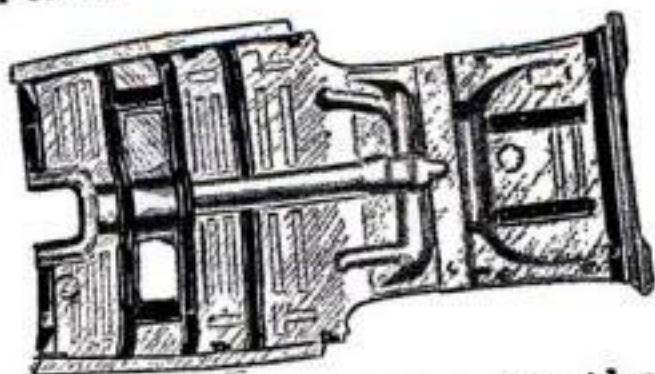


# NEW STRENGTH in the 1940 BODY BY FISHER

A casual observation will show that the 1940 Body by Fisher is longer and wider than its predecessors. And a structural analysis will reveal that it is also stronger and more solid. This increased strength is the result of several basic engineering advances, which are here demonstrated as they apply to the Body by Fisher on the new Buick Super.



**Turret Top — Higher Crowned** — Increased arching of the solid steel Turret Top, three sturdier roof bows, and stronger roof rails not only provide greater protection overhead — but actually help stiffen the entire body. The explanation is simple. In Unisteel construction every steel member becomes an integral part of the whole structure with no open seams anywhere. Thus the strengthening of any one part makes all of the body more rigid throughout.



**New Engineering at Vital Strain Points** — Considerable strengthening of the floor area also adds to the greater shockproof, weaveproof ruggedness of the new Body by Fisher. Sturdy steel channel braces, welded into place, reinforce the floor. And new steel brackets bolted to the outside of the chassis frame now extend to the rocker panels along the floor's outer limits. Likewise extended are the cowl bracing and rear wheel housing area reinforcements.



**New Double Steel Paneling** — This new Body by Fisher provides an improved wall construction that makes use of new double steel paneling. The solid steel inner panel is fused to the outer one as an integral part of the body construction, giving an all-over reinforcement instead of the occasional reinforcement provided by conventional channel bracing.



"Best buy's Buick" is popular advice this year. And a prime reason certainly is its striking new Body by Fisher. See how easy on the eyes it makes this Buick 4-door Super sedan here — inside as well as out — with clearer, stronger Hi-Test Safety Plate Glass not only in the windshield, but in all door windows and Ventipanes, too.



BODY BY  
**Fisher**

ON GENERAL MOTORS CARS ONLY:  
CHEVROLET • PONTIAC • OLDSMOBILE  
BUICK • LA SALLE • CADILLAC



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# *Big* enough for the job

We live in a big country and it takes a big telephone company to give good service to millions of people. The Bell System is doing its part in providing for the nation's telephone needs, whatever they may be.

But the Bell System aims to be big in more ways than mere size. It aims to be big in the conduct of its business, in its relations with employees and its plans for the future. All of this helps to give the nation quick, dependable, courteous telephone service at low cost.

**BELL TELEPHONE SYSTEM**







## Solid Bar Guard Sets Up Your Whiskers For Fast, Clean Shaves

**F**OUR basic improvements, including the solid bar guard, make the new Gillette Tech the easiest shaving razor any man ever used. No wonder Gene Sarazen says: "I wouldn't take big money for my Tech if I couldn't get another like it!" You'll be as enthusiastic from the first time you use this amazing razor . . . for it gives you the most refreshing shaves of your life.

NO MORE NICKS AND CUTS FOR ME SINCE I GOT NEXT TO THE TECH AND GILLETTE BLUE BLADES

Johnny Mize, Star First Baseman, St. Louis Cardinals



### Made For Each Other

You whisk off tough beard in perfect comfort . . . without any smart or burn . . . with the new Tech Razor and today's Gillette Blue Blade. That's because these two are precision-made for each other . . . fit exactly . . . work together perfectly. Today's Gillette Blue Blade has edges of an entirely new kind. They're sharper . . . longer lasting . . . and will protect your skin from the irritation caused by misfit blades. Ask your dealer for the new Tech Razor and five Gillette Blue Blades at only 49c.

## FOUR BIG IMPROVEMENTS

**1** RIGID BLADE SUPPORT  
SPEEDS SHAVING

**2** NON-SKID TREAD  
PROTECTS FACE

**3** CLEANS QUICKLY  
--NEVER CLOGS

**4** SOLID BAR GUARD  
ASSURES COMFORT

TECH RAZOR AND FIVE GILLETTE BLUE BLADES

**49¢**

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# HOW TO GET "MOST FOR YOUR MONEY" OUT OF A BATTERY



To get the maximum satisfactory service from your storage battery, follow these four points of battery care . . .

## **1 KEEP ELECTROLYTE AT PROPER LEVEL.**

Water must be added regularly to the battery, particularly during the summer months when evaporation is rapid, in order to keep the electrolyte at its proper level— $\frac{1}{4}$ " to  $\frac{3}{8}$ " above the separators. Distilled water is preferable, since the continued use of water with mineral content will eventually damage the battery. Excessive consumption of water is usually due to overcharging.

## **2 MAKE SURE THAT BATTERY IS TIGHT IN CARRIER.**

Excessive vibration shortens the life of a battery. Therefore, it is important to make sure that the clamps hold the battery firmly in its carrier. If clamps are too tight, the battery case will be damaged.

## **3 HAVE TERMINALS CLEANED PERIODICALLY.**

A good battery cannot deliver its full power to the electrical system if the terminals have become dirty or corroded. Have terminals, battery cables and cable connections inspected regularly, and the terminals cleaned, when necessary, with steel wool or baking soda water. Your battery will serve you better—last you longer.

## **4 KEEP BATTERY FULLY CHARGED.**

A battery does not store up electricity—it stores up *chemical* energy that is converted into electrical energy. A hydrometer reading will reveal whether the chemical condition of the battery is up to standard. Since this standard varies according to the temperature of the electrolyte and the length of time a battery has been in service, let your Delco battery dealer help you. Have him check your battery regularly, and avoid the danger of an undercharged battery.

## **MOST IMPORTANT OF ALL—GET A GOOD BATTERY TO BEGIN WITH**

Regardless of how much care you give to a battery, it won't give you good service if it wasn't *designed* and *built* right in the first place. The engineers who design Delco batteries have taken into account all the conditions that affect battery life and performance—heat, cold, vibration, starting, accessory

draw, self-discharge, and many other factors. They have used the information gained through years of building batteries for America's leading cars—40% of which are factory-equipped with Delco batteries. For long, dependable service, replace with a Delco—at your nearby Delco battery dealer's.

# Delco-Remy

**World's Largest Manufacturer of Automotive Electrical Equipment**



# America's Challenge To World's Finest Cameras!



**\$29<sup>75</sup>**

**EASY-PAYMENT TERMS  
AT MANY DEALERS**

**PROOF  
NOT CLAIMS!**

October 4, 1939.  
Universal Camera Corporation,  
28 West 23rd Street,  
New York, N. Y.  
Gentlemen:  
Our reports Nos. 149042, 149114, 149117 and  
149799 contain results of tests of shutter speeds of  
specimen cameras selected at random by us. The sam-  
pling was made from dealers' stocks. The tests were  
to determine the average effective exposure time of  
the specimen cameras at various speed settings. The  
accompanying data correctly represent our measure-  
ments at the respective maximum speed settings.  
Very truly yours,  
*S. McJ. Gray*  
S. McJ. Gray, in charge of  
Photographic Laboratory.  
ELECTRICAL TESTING LABORATORIES.

## Read Startling Truth About Shutter Speeds

Camera	Lens	Make	Claimed Speed	Actual Aver. Speed	List Price
UNIVEX MERCURY	f3.5	(American)	1/1000th sec.	1/1050th sec.	\$29.75
CAMERA "A"	f2	(Foreign)	1/1250th sec.	1/1000th sec.	\$285.
CAMERA "B"	f3.5	(Foreign)	1/700th sec.	1/550th sec.	\$171.
CAMERA "C"	f3.5	(American)	1/300th sec.	1/145th sec.	\$25.

Study the chart above! In view of these results, we invite you to **COMPARE** this sensational new Mercury with any speed camera retailing up to \$200—in price . . . accuracy of shutter speed . . . performance . . . and results! Before you buy any Candid Camera, see the 1/1000 second Univex Mercury at your dealer's today—or send coupon today for **FREE** illustrated booklet!

At only \$29.75 the Mercury truly embodies every important feature of the most expensive foreign-made cameras! Univex Cameras are 100% American-Made.

Universal Camera Corporation Dept. M-76, New York, N. Y.		<b>FREE</b>
Please send me illustrated booklet describing the many features of new Univex Mercury Super-Speed Camera.		
Name _____		
Address _____		
City _____	State _____	

**UNIVEX 1/1000<sup>th</sup> Second MERCURY**

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**"AL HAS A LOT  
ON THE BALL,  
ALL RIGHT!"**



## WHAT DO THEY SAY ABOUT YOU?

No ONE respects the man who doesn't carry his share of the load.

In your work, do you lack the training you need to hold up your end of the job? Do your fellow workers say: "We have to do our work, and his too!"?

Students of the International Correspondence Schools are almost always respected and well-liked—because they are *trained to do their jobs well!* And they're ready for a more responsible job when opportunity knocks!

Think it over! The coupon will bring you complete information—show you how you can become eligible for a trained man's position.

### INTERNATIONAL CORRESPONDENCE SCHOOLS

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Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:



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| <input type="checkbox"/> Bridge Engineering       |                                       | <input type="checkbox"/> Heat Treatment of Metals  | <input type="checkbox"/> Poultry Farming          | <input type="checkbox"/> Structural Engineering    |  |
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| <input type="checkbox"/> Chemistry                |                                       | <input type="checkbox"/> House Planning            | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Telegraph Engineering     |  |
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| <input type="checkbox"/> Concrete Engineering     |                                       | <input type="checkbox"/> Management of Inventions  | <input type="checkbox"/> Radio Servicing          | <input type="checkbox"/> Welding, Electric and Gas |  |
| <input type="checkbox"/> Contracting and Building |                                       | <input type="checkbox"/> Managing Men at Work      | <input type="checkbox"/> R. R. Section Foreman    | <input type="checkbox"/> Woolen Manufacturing      |  |
|   |                                       | <input type="checkbox"/> Manufacture of Pulp Paper |   |  |  |

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|--|--------------------------------------|--|---|---|--------------------------------------|
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| <input type="checkbox"/> Bookkeeping             |                                      | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship          | <input type="checkbox"/> Salesmanship                 | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> Business Correspondence |                                      | <input type="checkbox"/> Commercial          | <input type="checkbox"/> French               | <input type="checkbox"/> Service Station Salesmanship |                                      |
| <input type="checkbox"/> Business Management     |                                      | <input type="checkbox"/> Cost Accounting     | <input type="checkbox"/> Grade School         | <input type="checkbox"/> Sign Lettering               | <input type="checkbox"/> Spanish     |
| <input type="checkbox"/> Cartooning              |                                      | <input type="checkbox"/> C. P. Accounting    | <input type="checkbox"/> High School          | <input type="checkbox"/> Traffic Management           |                                      |
|  |                                      |  | <input type="checkbox"/> Illustrating         |   |                                      |
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|---|---|---|
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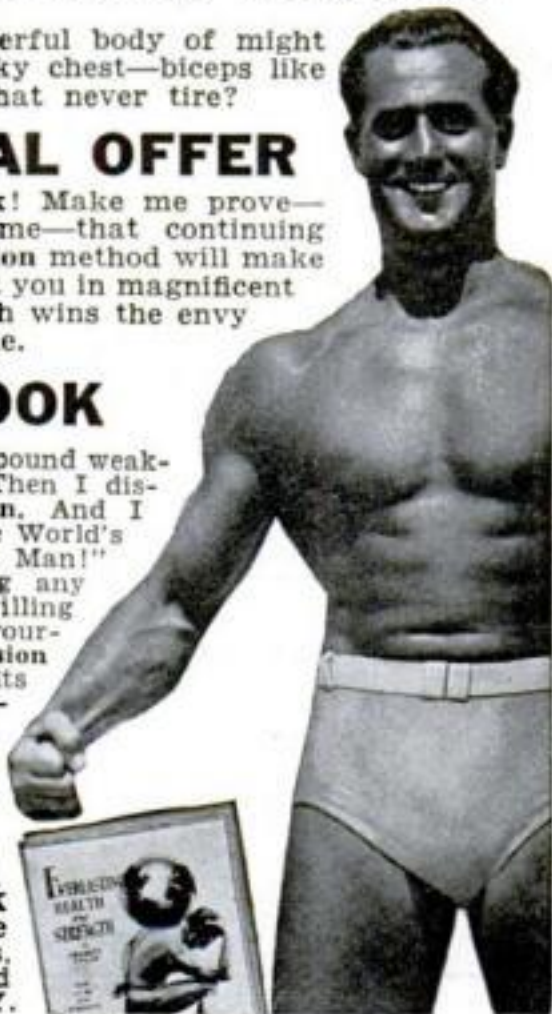
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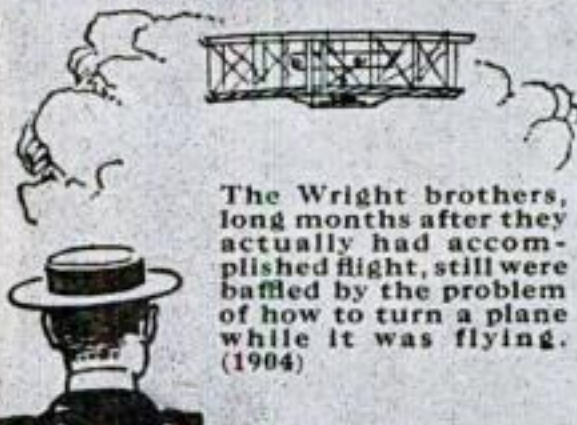





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<p>In 1900... Many doctors then practicing were not even high school graduates. High School had not been required at the time they entered medical school.</p> 	<p>In 1940... Schools of nursing require high school graduation because most of them are conducted at college level. Progress has made modern nurses' training equal or superior to that available to many old time doctors.</p> 																		
<p>The Wright brothers, long months after they actually had accomplished flight, still were baffled by the problem of how to turn a plane while it was flying. (1904)</p> 	<p>Thousands of schoolboys 14-16 years of age know more today about airplane design than the Wrights knew at Kitty Hawk.</p> 																		
<p>In 1900... The High School Graduate was a person of distinction. Only one person in 800 had finished high school.</p> 	<p>In 1940... More than a MILLION boys and girls completed high school. Graduates now are commonplace. High school is minimum educational requirement in most lines.</p> 																		
<p>In 1900... Very few even thought of going to college, unless to enter one of "the learned professions." The number of college graduates in business and industry was so few that they formed practically NO COMPETITION in the average job.</p> 	<p>In 1940... Almost exactly as many are being graduated from college, today, as from high school 40 years ago. Everywhere—in everything you do—in commerce, industry, personal affairs, you are up against the competition of COLLEGE GRADUATES.</p> 																		
<p>In 1900... The "little red school-house" did a pretty fair job of equipping men and women to make their way in the world.</p> 	<p><b>American School, Dept. H-546, Drexel Ave. at 58th St., Chicago, Illinois</b></p> <p>Gentlemen: I'll sit down and consider my Promotion Problems carefully if you will send me <b>FREE</b> information covering subject checked. No obligation.</p> <table border="0"> <tr> <td><input type="checkbox"/> HIGH SCHOOL COURSE</td> <td><input type="checkbox"/> Radio and Television</td> <td><input type="checkbox"/> Business Management</td> </tr> <tr> <td><input type="checkbox"/> Diesel Engineering</td> <td><input type="checkbox"/> Salesmanship</td> <td><input type="checkbox"/> Aviation</td> </tr> <tr> <td><input type="checkbox"/> Drafting and Design</td> <td><input type="checkbox"/> Air Conditioning</td> <td><input type="checkbox"/> Electrical Engineering</td> </tr> <tr> <td><input type="checkbox"/> Liberal Arts</td> <td><input type="checkbox"/> Accounting and Auditing</td> <td><input type="checkbox"/> Electrical Refrigeration</td> </tr> <tr> <td><input type="checkbox"/> Private Secretary</td> <td><input type="checkbox"/> Architecture and Building</td> <td><input type="checkbox"/> Business Law</td> </tr> <tr> <td><input type="checkbox"/> Mechanical Engineering</td> <td><input type="checkbox"/> Automotive Engineering</td> <td><input type="checkbox"/> Retail Merchandising</td> </tr> </table> <p>Name.....</p> <p>Address.....</p>	<input type="checkbox"/> HIGH SCHOOL COURSE	<input type="checkbox"/> Radio and Television	<input type="checkbox"/> Business Management	<input type="checkbox"/> Diesel Engineering	<input type="checkbox"/> Salesmanship	<input type="checkbox"/> Aviation	<input type="checkbox"/> Drafting and Design	<input type="checkbox"/> Air Conditioning	<input type="checkbox"/> Electrical Engineering	<input type="checkbox"/> Liberal Arts	<input type="checkbox"/> Accounting and Auditing	<input type="checkbox"/> Electrical Refrigeration	<input type="checkbox"/> Private Secretary	<input type="checkbox"/> Architecture and Building	<input type="checkbox"/> Business Law	<input type="checkbox"/> Mechanical Engineering	<input type="checkbox"/> Automotive Engineering	<input type="checkbox"/> Retail Merchandising
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## To Get Ahead Today You **MUST** Finish High School

Alice in Wonderland learned: "You must run as fast as you can in order to stay where you are. To get anywhere, you must run **TWICE** that fast."

Your own life, today, is like that. During the day, you must try as hard as you can—as well as you can—in order to be sure of holding what you already have. To get anywhere in commerce, industry or socially—to win a better job—bigger pay—greater success in your social activities—you must make **EXTRA** effort in your **SPARE** time to meet the competition of better educated people.

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# Our Readers Say



## Maybe the Time Has Come To Harness the Inventors

FRANKLY, I'm getting just a little bothered about this idea of harnessing atomic power, now that it's being talked of more and more seriously. It's bad enough to be burning up our coal and oil and such like, with known reserves rapidly dwindling. Maybe when they're all gone, though, the chemists will figure out a way to make a substitute—such as taking plants, which can use the carbon dioxide from smokestacks, and turning the fiber into combustibles. If so, nothing's irretrievably lost.

THAT WILL BE A JITTERBUG'S PARADISE!



But when it comes to busting up atoms right and left, what have you got? Just energy, if I understand it rightly. Do you eventually use up all the atoms? I just can't imagine tables and chairs—and people, too, doggone it—made out of nothing more substantial than potential or kinetic energy.—Y. R., Miami.

## Who Can Offer Some Ideas on This Sound Reasoning?

NOWHERE have I heard or read of an attempt to solve the problem of noise—meaning all kinds of unwanted sounds—by the application of known radio principles. What is the matter with America's brilliant engineers? Perhaps it is because my own knowledge of sound and radio is so elementary that I fail to see the impossibility of eliminating noise with an audio-amplifying apparatus. If it is true that two sound waves of identical characteristics are inaudible when the condensations of one fill the rarefactions of the other, then why can't a microphone and apparatus be so constructed that any sound wave impinging on the microphone would either be slowed up or reversed in the apparatus, so that the sound wave which emerged from the speaker would balance with the original sound wave to create silence? As I have said, my knowledge of such things is elementary.—J. P., Brooklyn, N. Y.

IF HIS KNOWLEDGE IS "ELEMENTARY", WHERE DOES THAT LEAVE ME?



## Proving You Can't Believe Everything That You See

THERE are several ways of arriving at the answer to the isosceles-triangle problem submitted by W. E., of Baltimore, Md. One is by means of simple plane geometry. Another is by trigonometry, setting arbitrary values for given lines. Still another is by construction and direct measurement, and there are probably many other ways. They all give the same answer, namely, that the triangle of dubious definition is not isosceles, appearances to the contrary notwithstanding.—M. M., Green Bay, Wis.

## This Should Give the Bird to the Bothersome Sea Gulls

DON'T get excited at hearing from this neck of the woods; we read your wonderful magazine and like it immensely. In the March issue, S. B., Stapleton, N. Y., seems to be stumped on how to prevent the gulls from setting off the electric-eye alarms that guard the New York free port. Tell him to set the alarm to go off only if the beam is interrupted for about one second, which would allow the gull to pass through the beam. This would work unless the gull rode the beam, which is unlikely. Another method: Have two beams parallel to each other and about three feet apart, arranged so that interruption of both beams at the same time would be necessary to set off the alarm. That ought to take care of the gulls and harbor pirates too.—T. J., Pine Bluff, Ark.

WE'RE NOT ALL HILL-BILLIES DOWN HERE!



## Man Beats the Chameleon at Changing Color

WHEN I read the interesting article on color, in your April issue, I was reminded of the large number of popular ideas about color expressed in common sayings. When a man is discouraged, he is blue; when he gets mad, he sees red; if he's afraid to fight, he is yellow; to think, he goes into a brown study; before he gets experience, he is green; if he's a good fellow, he is white; if not, he has a black heart; if he paints the town red, he wakes up next morning with a dark-brown

(Continued on page 14)





**IF** you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period in your life? Always provided that the rewards were good—a salary of \$2,000 to \$10,000?

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing*!

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then the more difficult ones. If you could do this—and if you could turn to him for advice as the problems became complex—soon you'd master them all.

That's the training you follow in principle under the LaSalle Problem Method.

You cover accountancy from the basic Principles right up through Accountancy Systems and Income Tax Procedure. Then you add C. P. A. Training and prepare for the C. P. A. examinations.

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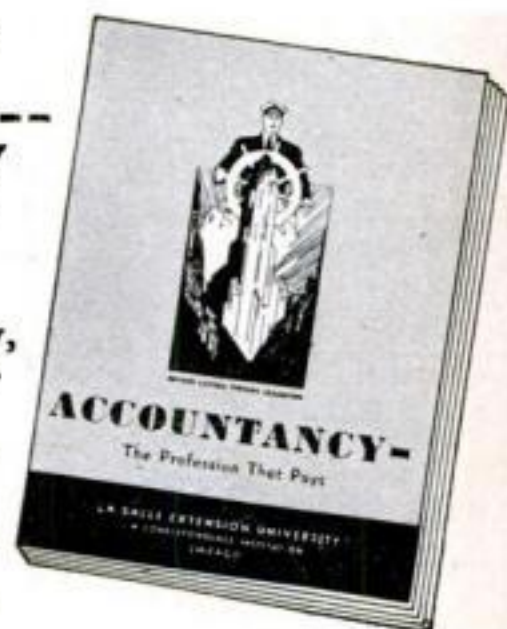
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# Our Readers Say (CONTINUED)

taste in his mouth. Maybe your color experts will discover the psychological basis for these expressions.—G. E., Kansas City, Mo.

## Before Washing His Hands of It He Cut It out of Soap

THE answer to the problem in the March issue, which asked for the volume cut out of

WASTING MY BEST  
TOILET SOAP!



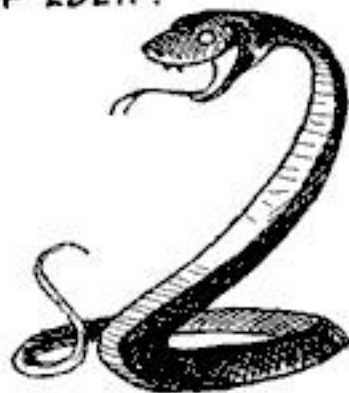
a 1" round bar by a 1" drill, with their axes inclined at 45° and intersecting, is two thirds times the square root of two, or approximately .9428 cubic inches. This problem is an easy one in single integration, the only trick being in choosing the elements of volume so as to give an easy expression

to be integrated. Since the actual volume cut out is rather hard to visualize, I cut a model out of soap.—P. C., Buffalo, N. Y.

## Seems To Be Something To Say on Both Sides of the Matter

THE purpose of my first letter to you is to inform you of a snake story that undoubtedly explains the origin of the legend of snakes swallowing their young, which was mentioned in your article in March by C. B. Perkins. In the summer of 1938, I was hiking in upper Wisconsin with a friend, when about noon one day we heard the familiar rustle of crawling snakes in the grass. Naturally we stopped to

HAW HAW, EVER  
SINCE THE GARDEN  
OF EDEN!



see if there was any danger, and as we watched a female king snake emerged from the grass into a clearing. The mother snake was facing us now, and her following young squirmed to her yawning mouth and disappeared—apparently being swallowed up. Then the mother coiled up as if to warn us. We threw a few stones at her and she finally uncoiled and moved back. In doing this, she revealed her secret. There was a hole in the ground that she had partially covered with her head. It was in that hole that her young had gone, and they were definitely not swallowed by the female snake.—M. A. P., Notre Dame, Ind.

MY BROTHER and I, when we were boys, saw  
(Continued on page 16)

a large snake lying by a pond where we often played. When we went up to her, she opened her mouth, made a slight noise, and several small snakes came out of the grass and went into her mouth. We killed her, cut the upper part of her open, and the small snakes came out and went into the grass.—C. W. H., Rochester, Mass.

## When One Reader Praises Another, Brother, That's News!

AND I WAS READY TO  
BITE A DOG!



IT SEEMS to me that the reply of L. H., of Minneapolis, Minn., to the question of economical temperature control of the home that was submitted by O. T. F., was the most complete and concise outline on the subject that I have ever read. He just took the very words right out of my mouth.—H. B. H., Philadelphia, Pa.

## This Puts the Subject Pretty Much on Ice!

Toss this in the wastebasket if you think I'm going out on the well-known limb. I refer to R. C. R.'s "tip on a frosty subject" dealing with the formation of frost. I would like to qualify his statement that frost is not frozen dew, and point out that dew can freeze and give us something we'd certainly call frost. I think he should have made clear also that it *may form* by the direct change of moisture in the air into ice crystals on a surface that is below the freezing point, as in his cocktail-shaker analogy. Moreover, he overlooks another way in which frost can appear. Let's say dew has formed on the ground. The ground and the air are both at 32° F. A breeze comes up and causes evaporation of some of the dew. When water evaporates, it loses heat, and water at 32° losing heat will soon freeze. Result: frost again.—T. R., Easton, Pa.

DON'T GO SPOILING A  
NICE POEM BY GETTING  
TECHNICAL!



... Mine is a very incomplete explanation, and the various phenomena of frost and related forms would fill pages. I will admit that the dictionaries are not very clear, some saying that frost is frozen dew. A better



# INVENTORS

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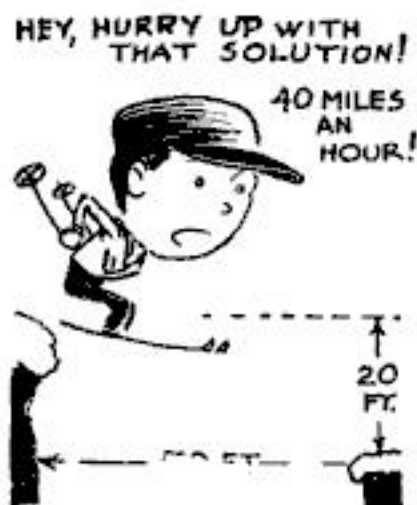


# Our Readers Say (CONTINUED)

reference is a good encyclopedia or elementary science text. Hoping this is not too frosty.—L. R. B., Mosinee, Wis.

## What Was the Fate of This Surprised Skier?

A FRIEND tells me that a skier, flashing over the snow at forty miles an hour, suddenly had this harrowing experience. A bottomless crevasse loomed up ahead of him too late for him to avoid it; in fact, too late for him even to spring upward to increase his trajectory. The distance measured fifty feet to the other side. There was a twenty-foot drop between the take-off level and the possible landing level. But my friend has left me in suspense over the fate of the skier. Did he make it? Or did he fall into the crevasse?—C. H. N., New Haven, Conn.



## Wouldn't a Good Telescope Accomplish the Same Thing?

THE theory submitted by W. M. that man may in time become sensitive to radio waves—a sort of walking radio circuit—is, according to the facts he stated himself, highly improbable. In perceiving colors, or "minor variations in wave lengths that we perceive as color," the eye is sensitive *within* a particular band of wave lengths known as the visible band. It is true that radio waves, like light, are ether waves, but they are about a billion times as long as light waves. Besides, our vision depends upon diffraction of light waves and their being focused on the back of the eye. The diffracting medium is a lens, and unless you change the eye to a radio receiver, we will have a lot of trouble detecting the diffraction. After all is said and done, just what would we see?—J. S., Asheville, N. C.

WE STILL HAVE TELEPATHY, OR HAVE WE?



## Here's a Little Item That's Bothered a Lot of People

It's a long time since I've studied mathematics, so maybe I've just forgotten the explanation for certain deficiencies in our numerical system. Some of your readers

doubtless can straighten me out in no time with a few well-chosen words. I'd appreciate it a lot. Here they are: Why is it that we cannot divide any given number by zero? And why is it that we cannot extract an even-numbered root of a negative quantity? I should probably add that in the first case, the answer "infinity" is suggested. At best, the answer is no answer, because infinity is not a number. In the second case, getting around taking the square root of, let's say, minus four by saying it is equal to two times the square root of minus one, still leaves the square root of minus one unsolved. In view of all the seeming-impossible things we can do with numbers, isn't it amazing that we have to bog down on these simple-looking problems! Or do we?—W. M., Medford, Mass.

## Robot Competition Puts Sneezers Out of Work

THERE has been a lot of talk about technological unemployment—people being deprived of jobs by machinery—but the worst case of the kind that I have seen is the "mechanical sneezer" you describe in your April issue. With all the human coughers and sneezers there are around, why in blazes do they have to construct a machine to do it? In the fall, winter, and spring, the scientists could enlist plenty of people with colds to do their coughing and sneezing at reasonable rates, while in summer they could fall back on the vast army of hay-fever sufferers. Not long ago, you told about a mechanical kisser. If this keeps on, machines will soon be doing everything, and there will be nothing left for people to do—except pay for the machines.—L. A., Augusta, Me.

WHEN NOBODY CAN BUY THE MACHINES WE'LL HAVE TO START ALL OVER!



## FEBRUARY LETTER CONTEST PRIZE WINNERS

THE following are the prize winners of the Letter Contest announced in our February 1940 issue:

First Prize, \$50: Mrs. Ella Bankard, Detroit, Mich.

Second Prize, \$25: Eugene J. Cox, Galax, Va.

Third Prize, \$15: M. E. MacPherson, Bourlamaque, Quebec, Canada.

Fourth Prize, \$10: Cyril Clupper, Wabash, Ind.



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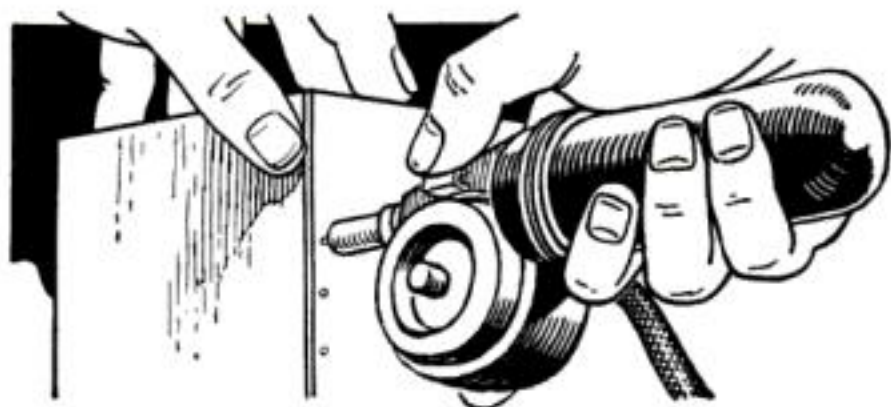
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# With the Inventors

**P**OWERED by compressed air, an automatic hammer developed by Ludwig Oeckl, a German inventor, is designed to drive as many as 100 nails a minute. A container built into the device holds a supply of nails which are driven into the work one at a time as a thumb lever is pressed. A boon to expert carpenters in speeding up their



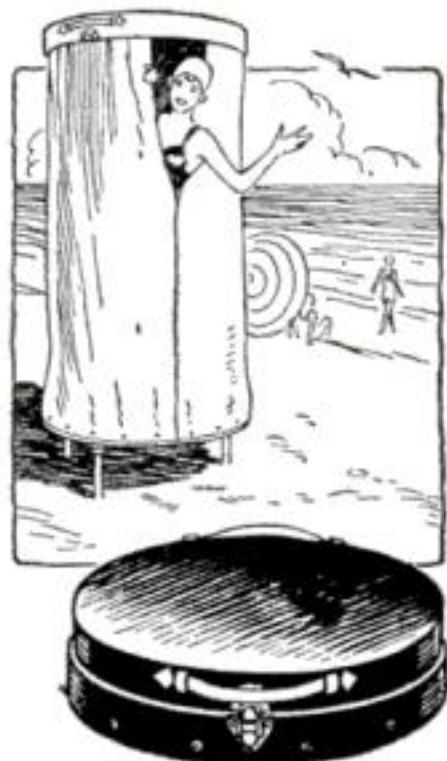
work, as well as to home owners who end up with damaged thumbs whenever any nailing is done, the apparatus will hammer nails of various sizes, and even small brads and tacks that are difficult to hold in position for driving with an ordinary hammer . . . IN GENERAL, THE SHORTER a patent claim is, the more ground it covers. Long claims are normally much more limited in scope than short ones . . . SO THAT A MAP SHOWING GREAT



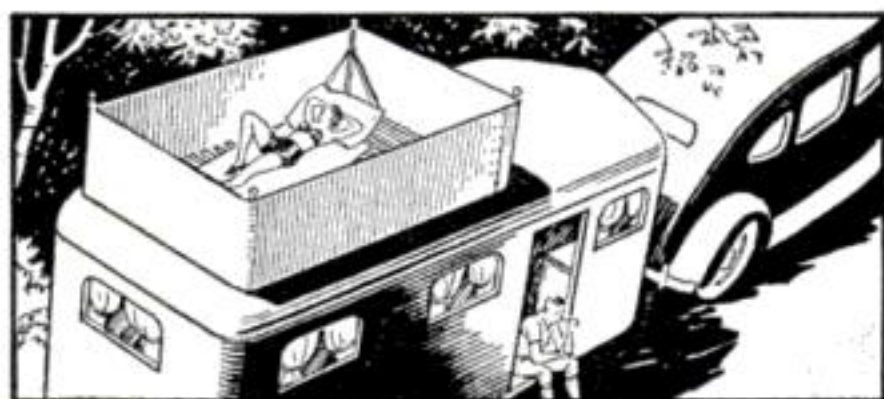
DETAIL or covering a large territory may be mounted on a small globe and yet be easy to read, Charles A. Marks, of Elkhart, Ind., has designed a novel magnifying globe small enough to fit on an automobile instrument panel or to be stored in a desk drawer. A small globe on which the map is mounted is surrounded by a metal casing into which a magnifying lens is fitted. Looking through the lens, the user manipulates a lever to bring the desired map section into view through the magnifying lens... IF AN INVENTION was described in any printed publi-

cation more than two years before a patent application for it was taken out, that invention cannot be patented, since it is not considered new or novel . . . COLLAPSING INTO A SPACE LESS THAN that of a hat box, a porta-

ble bath house that is the invention of Abbie Jo Wilson, of Orono, Me., should prove handy for changing into bathing suits at the beach. The device employs a framework of sectional tubular rods, joined together in an upright position so that the top of the clothes-changing stall is six feet or more above the ground. From this top a thin, opaque curtain is hung to form a cylindrical space large enough to stand in. The portable bath house is entered through a slit in the curtain which can be closed by means of a slide fastener. If desired



the unit can be set up at half its six-foot, bath-house height to serve as a picnic table . . . ANY PATENT, EVEN THOUGH it has been issued, is invalid if it has been granted on the application of anyone other than the real inventor . . . A ROOF-TOP SOLARIUM for house-trailer owners who like to sun-bathe is the subject of an invention worked out by Stanley C. Tesmer, of Berkeley, Mich. Designed to be reached from the interior of the trailer by means of a folding ladder and a trapdoor in the trailer roof, the unit has a floor of lightweight slats bolted at intervals to the roof. An upright post is arranged at each of the four corners, and around these is



stretched an opaque screen made of canvas . . . MORE THAN SIXTY PERCENT of the patents taken out in Canada are filed for inventors who live in the United States . . . A MINIA-TURE CAMERA WORN on the wrist like a watch is the novel invention of Kieth M. French, of Watertown, N. Y. Curved to fit the wrist, the camera has a face marked with numerals and watch hands to make the outfit mas-

(Continued on page 22)



# A frank man-to-man talk about PATENTS-INVENTIONS and SELLING INVENTIONS

The world of invention moves on. Yet about fifty years ago, some people were saying, "Well, there isn't much left to invent." Today we know that that is one of the funniest things ever said. Just think what has happened in the last fifty years: Autos, radios, airplanes and thousands of useful, practical devices for home, shop and office have been put on the market. Inventors are constantly making the world a better place to live in.

Interesting examples: Hans Wach, an obscure worker, invented a simple device to utilize exhaust steam on ships. A report states that *already steamship lines have saved more than \$15,000,000 on fuel bills with his invention.* The Department of Commerce has announced that it will test out a new airplane. The inventor states that the average man can learn to fly in a day; that it will travel at the rate of 110 miles an hour and will sell at the price of a cheap automobile. Seattle man invented a robot to go 5,000 feet under the sea and recover millions and millions of dollars worth of gold lying at the bottom of the ocean since the days of the early Spaniards.

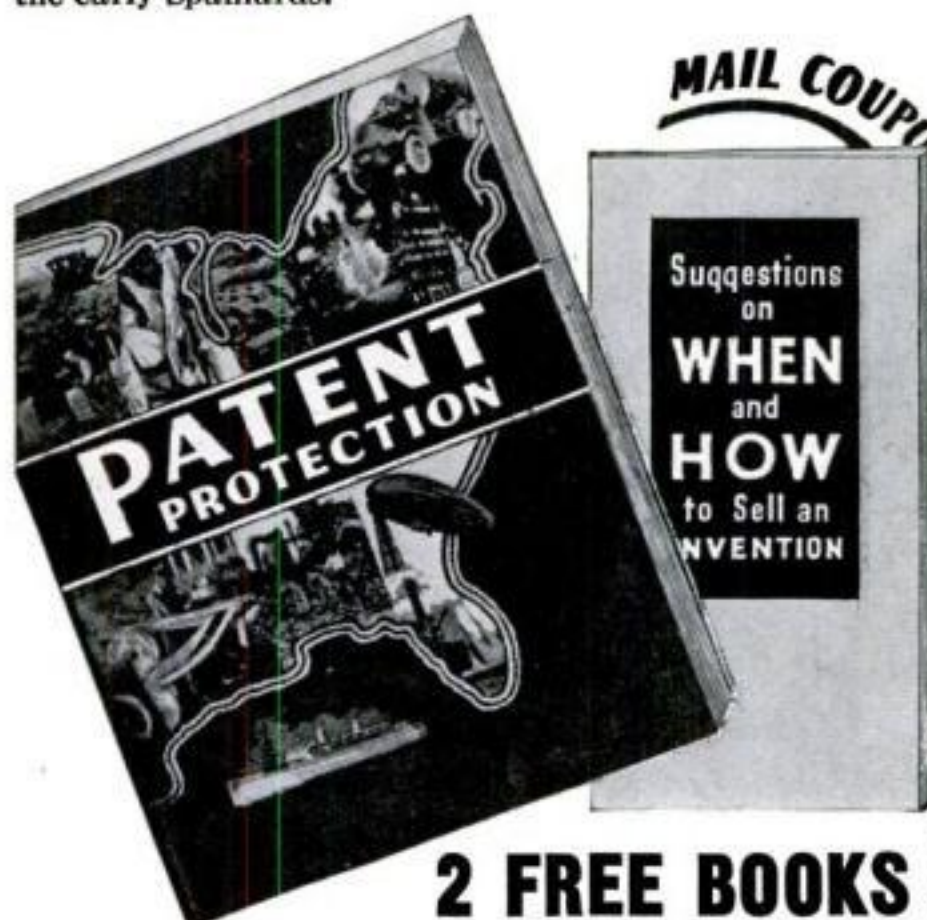
## Little ideas may have BIG commercial possibilities!

*But remember this:* For every outstanding, big invention, there are thousands of small, simple things for use in the home, office, factory, on the farm, on every sort of conveyance. Little articles like you find on the counters of a 10-cent store, hardware store, drug store, toy and novelty shop. A person finds something that doesn't work right, or it's clumsy or costs too much. He gets a happy thought. He improves the old article. That's a contribution to human progress. That's the way that many, many men have reached the goal of financial comfort, independence and even wealth. Most of the things we use today didn't come from the brains of engineers and physicists. They came from the mind and perhaps the crude home workbench of Mr. Average Man, busily engaged in earning his bread and butter at whatever chance or circumstance has given him to do. The "LITTLE" MAN'S OPPORTUNITY AS AN INVENTOR WAS NEVER GREATER THAN IT IS TODAY.

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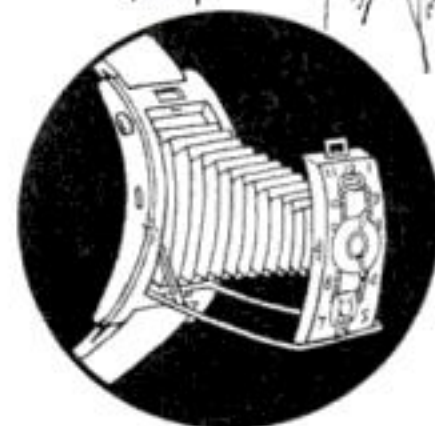
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## With the Inventors

(Continued from page 20)

querade as an ordinary wrist watch. In use, the lens mounting is pulled out from the main frame and film-holder of the unit, the two being connected by a collapsible bellows, as shown in the circular drawing. A view finder is placed on top of the camera face, while the shutter-release lever juts out from one side



... WITH THE SOLE EXCEPTION of employees of the U. S. Patent Office, any bonafide inventor may secure a U. S. patent, no matter whether he is an alien, a child of ten, an illiterate, or the inmate of a psychopathic ward . . . MANY A PARENT WHO OWNS a four-door automobile has worried about the possibility of a child playing with a rear-door handle, accidentally opening it, and falling out, while the attention of the driver was concentrated on the road ahead. A solution to this problem, made by Burnie J. Craig, of Los Angeles, Calif., is a door latch that is very hard to move when the automobile is in motion but which can be readily operated when the vehicle is at rest. The mechanism of the novel door-latch control employs a spring whose tension is controlled by an electrical system actuated by the car speedometer . . .



SIXTY DOLLARS IS THE TOTAL amount of the Government fees required for taking out a simple mechanical patent having less than twenty claims . . . BETTER RIDING QUALITIES, simplification, and reduced manufacturing costs are claimed for an odd motor cycle invented by Trenor P. Judd, of Cairo, Ill. Having an exceptionally long wheel base that requires an elongated frame and handle-

(Continued on page 24)



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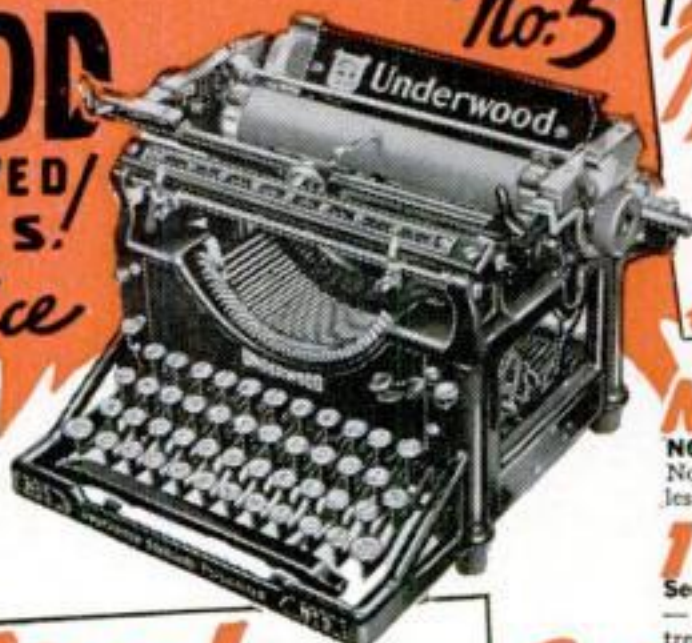
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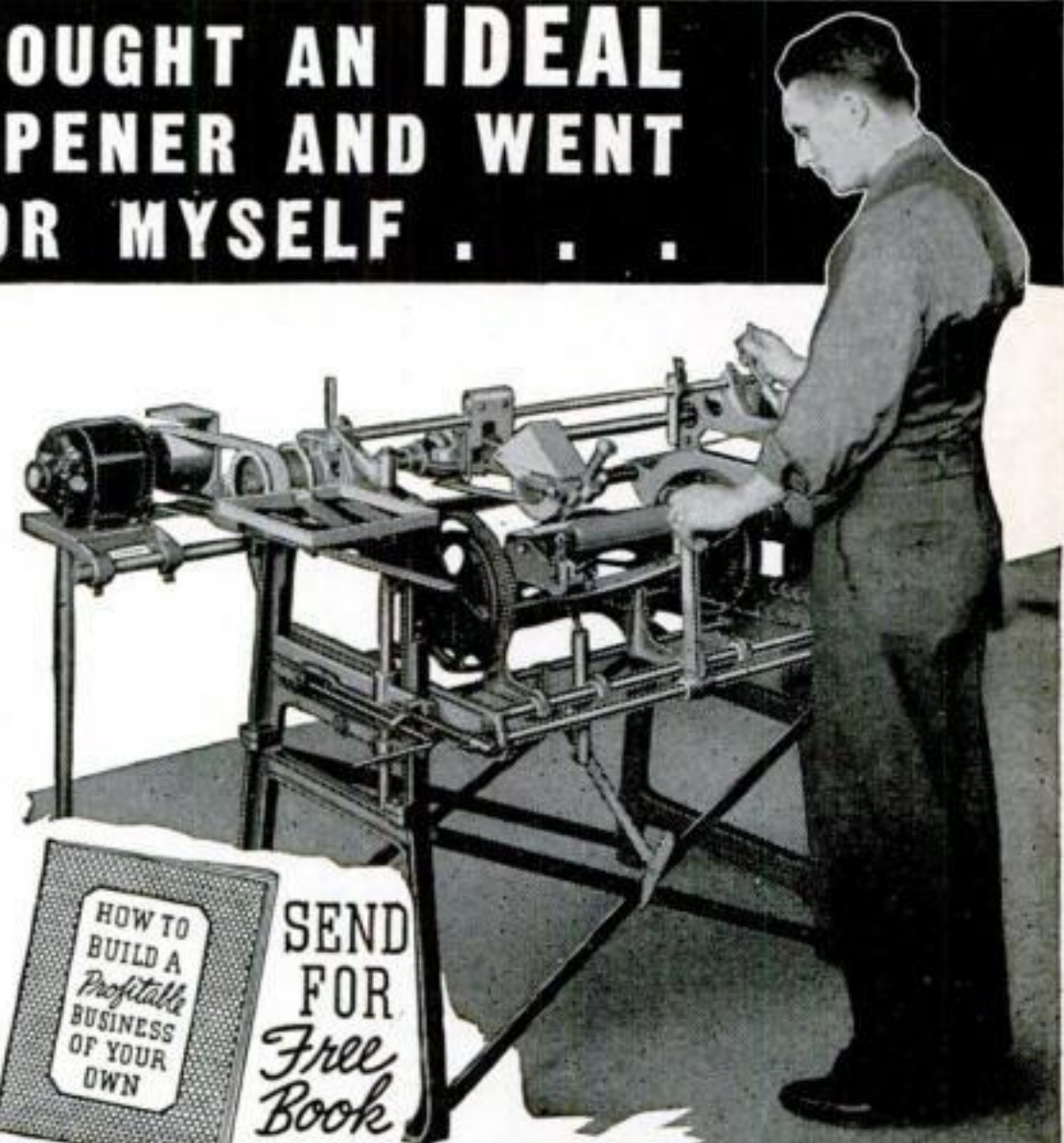


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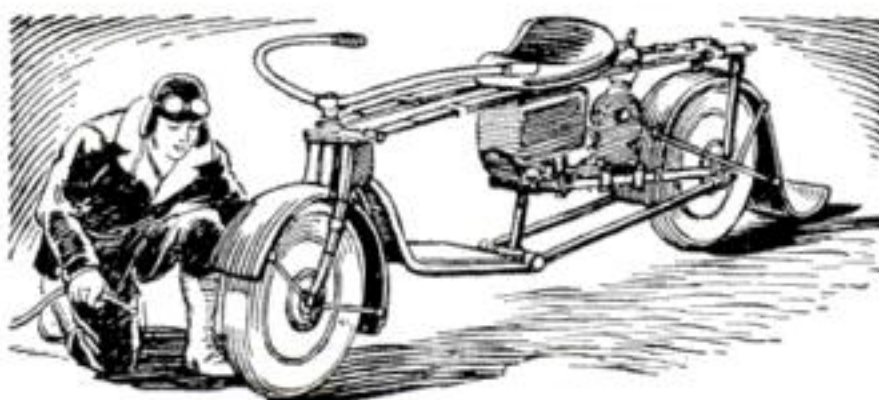
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## With the Inventors

(Continued from page 22)

bars, the motor cycle has its engine mounted between the centrally placed saddle and the rear wheel which is driven by a chain connecting it with the motor. The fuel tank is positioned below the saddle, and a curved extension of the rear mudguard serves as a novel stand for keeping the cycle upright when at rest . . . DESIGN PATENTS RUN FOR



a period of three and one half, seven, or fourteen years . . . WITH THE AID OF A NOVEL DEVICE invented by Donald B. Dickinson, of Silver Creek, N. Y., garage mechanics and service-station attendants can examine the underside of an automobile without having to crawl beneath it with a flash light or extension light. The unit consists of a box-like structure mounted on three wheels, and having a rectangular mirror mounted horizontally on its top between two transparent glass strips which allow built-in light bulbs to throw their beams upward. At one end of the unit a reflecting mirror is placed in a tilted position, as shown in the illustration, making it easy for an attendant to roll the device under the car, turn on its light bulbs, and examine the underside of the car . . .

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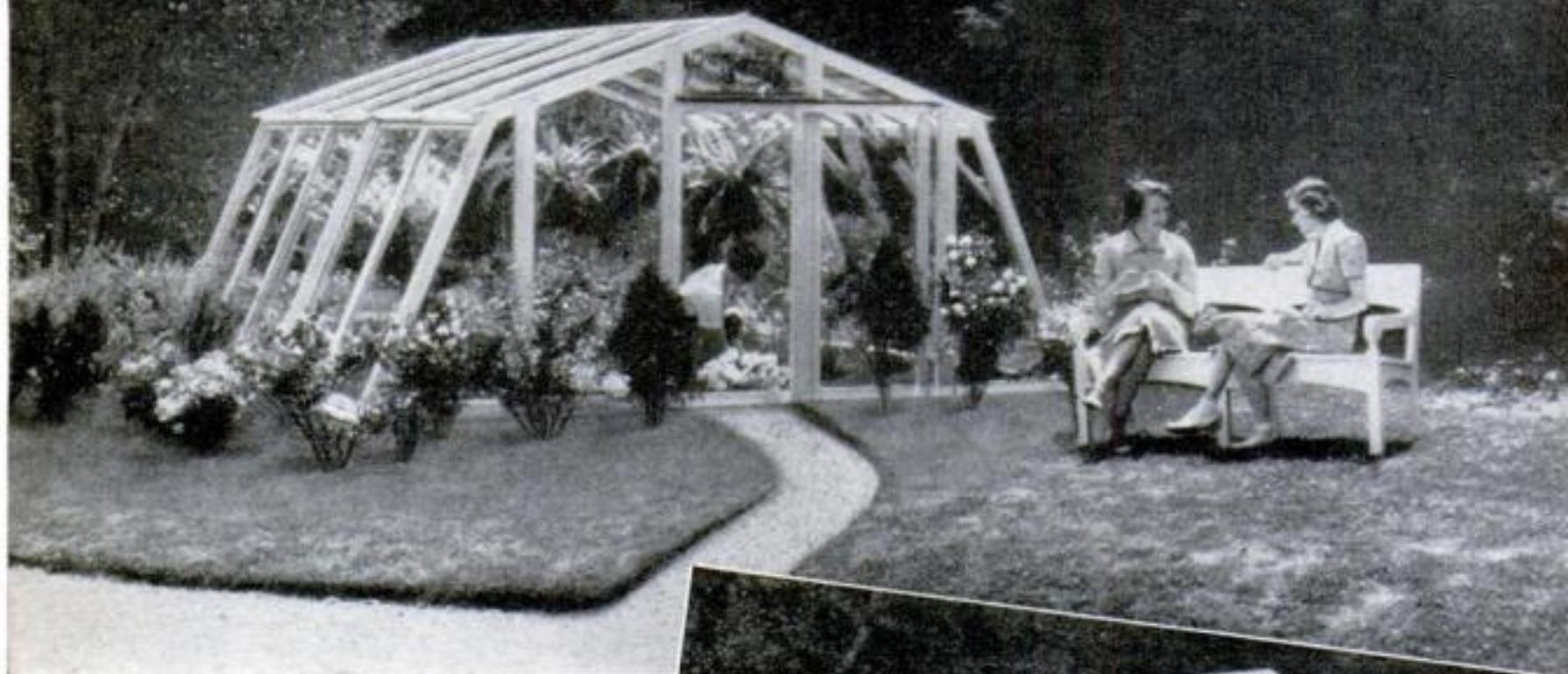
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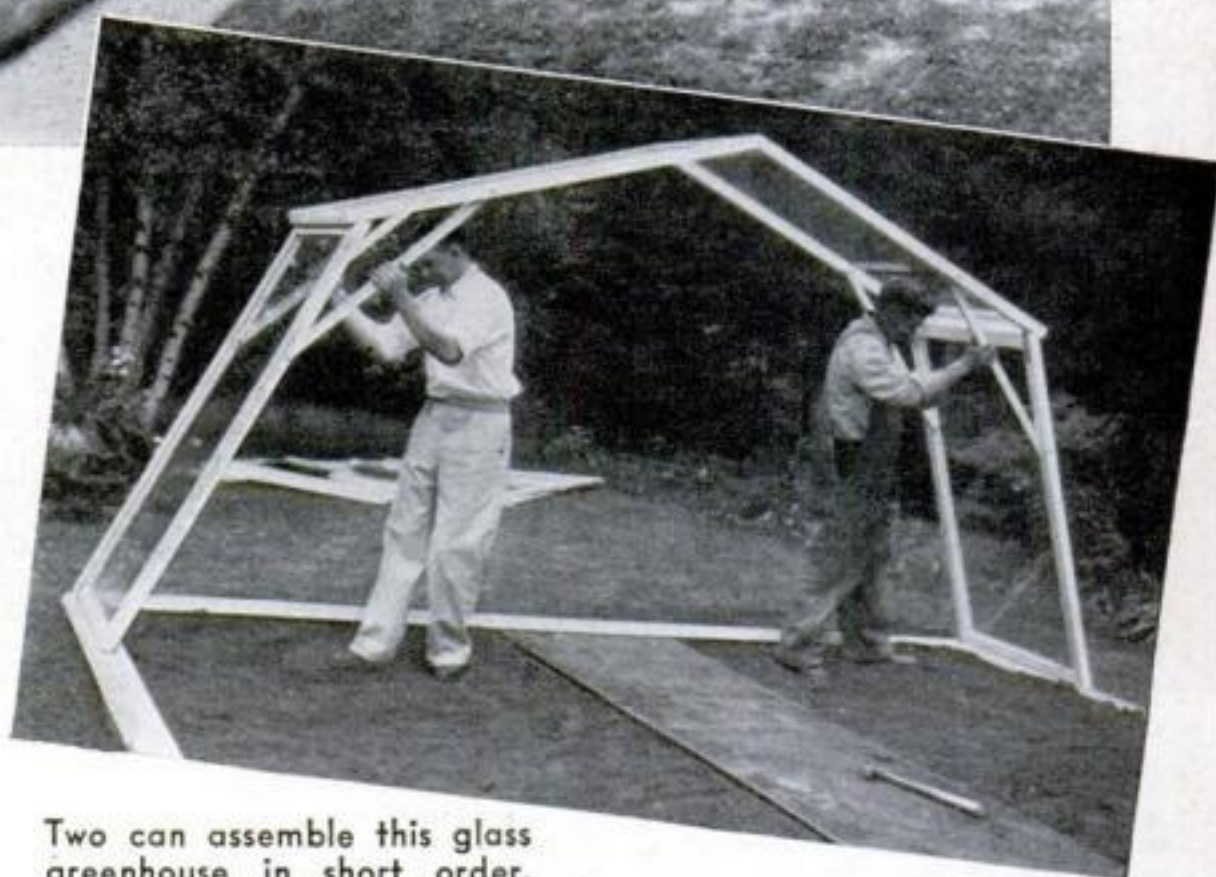


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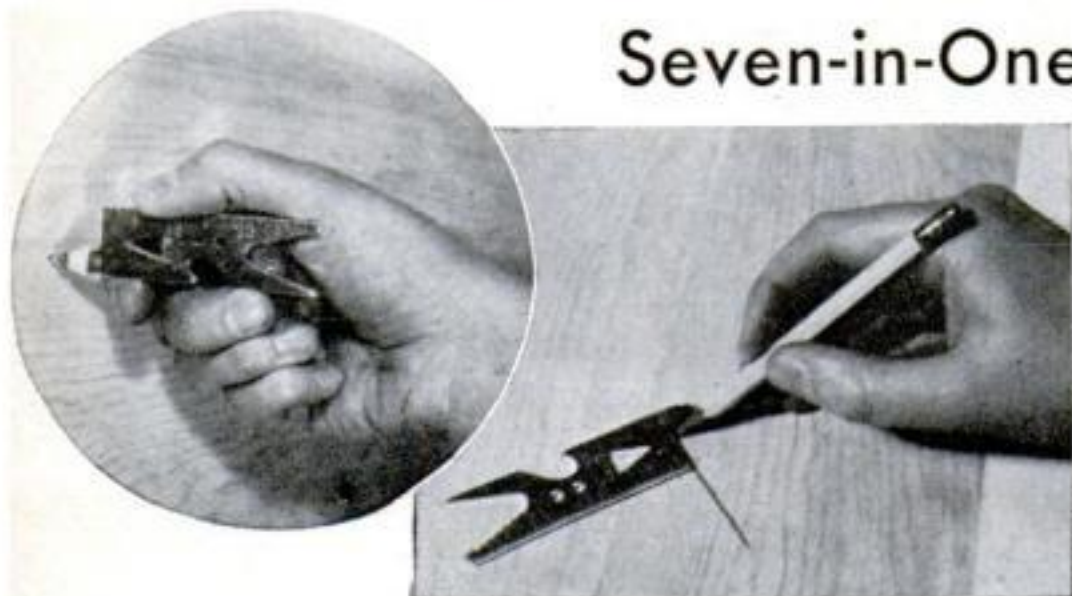
**S**HIPPED in knock-down form, a complete portable glass greenhouse is now available for home owners who have extensive garden space or a large back yard. Suitable for winter planting of fruits, vegetables, and flowers, the greenhouse can also be used in more northern areas for early spring planting when the weather is still too cold to plant outdoors. Since the structure is so easy to erect, it can be moved to any location where there is fresh soil, making it unnecessary to transport heavy loads of earth to a fixed structure. The glass walls of the greenhouse extend down to within four inches of the ground, thus eliminating



Two can assemble this glass greenhouse in short order. It comes in knock-down form

practically any shadow areas within the building. Although the portable greenhouse is shown in the top photograph above set up by itself in a home garden, it may also be erected against a porch or the side of a house if such an arrangement is desired.

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**A.**—Floor wax can be readily removed with a cloth moistened, but not wet, with alcohol.

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**F.M.K., DES MOINES, IOWA.** Before attempting to use sawdust and similar materials for house-insulating purposes, you should first treat them thoroughly. To make the material fireproof, add five pounds of monoammonium phosphate and five pounds of borax to every 100 pounds of the sawdust. To prevent decay and to discourage insects, add three pounds of sodium fluoride to the quantity mentioned above. Dampening the material before adding the chemicals will make the task less dusty, but the final mixture should be absolutely dry before it is packed into the house walls. Moreover, if there is any possibility that the treated sawdust might become wet while in place in the walls, abandon the idea of using it for insulation, since, if wet, the treated sawdust might be dangerous.

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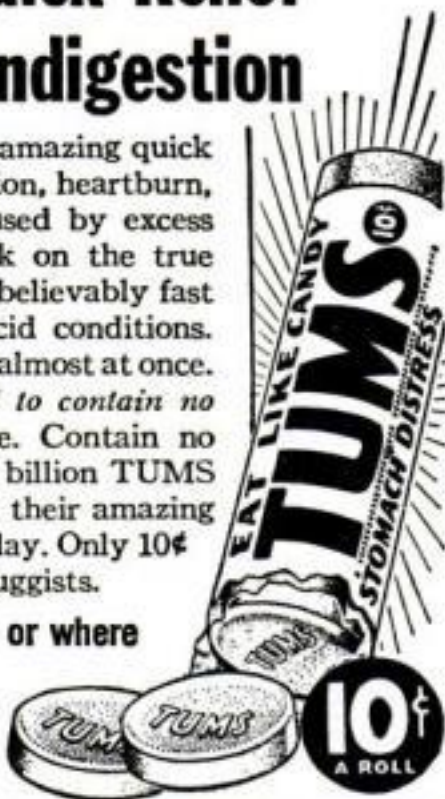
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**MONEY** to be made in poultry in 1940. Poultry Item tells why and how. This leading poultry magazine 4 months for 10 cents. Highly illustrated. Best writers. The Poultry Item, Box 18, Sellersville, Penna.

#### PRINTING, MULTIGRAPHING, MIMEOGRAPHING, LABELS

**WEDDING** invitations. 50 sets \$3.00. Additional 50s \$1.50. Embossed! Andy's Printery, Cleveland Ave., Amsterdam, N. Y.

**PRINTING** cuts made; finest quality. \$1.25 up; Save money, line cuts, halftones, electros, stock cuts, artists; free price list. Riteway, 1465-SM Broadway, New York.

**HAMMERMILL** letterheads, any color paper, ink; 300 8 1/2 x 11, \$1.48 postpaid. 30 type styles. Free particulars. Woodruff's, 217D Lewis, Duluth, Minn.

**125 8 1/2 x 11** TWENTY pound Bond letterheads and 125 envelopes \$1.00 postpaid. Benneville, 907 West Roosevelt, Philadelphia.

**40 SHEETS**, 20 envelopes, 25c postpaid. Agents Wanted. Samples Free. Western Stationery, Topeka, Kansas.

**CUTS** 2x3" from drawings and photos \$1.00. Joe Rek, 118 Gazette Ave., Lexington, Ky.

**ASK** for our 65c printing bargain. Sicoan, 2038 Obear, St. Louis.

**1,000 6 3/4** Envelopes, good gumming, \$1.75. Berliner, 3581 Milwaukee, Chicago.

#### PRINTING OUTFITS & SUPPLIES

**PRINT** your own cards, stationery, circulars, advertising. Save money. Easy rules furnished. Print for others, big profits. Junior outfits \$8.25, senior outfits \$16.55 up. Details free. Kelsey Presses, H-8, Meriden, Conn.

**HAND** presses, type and complete printers supplies. Send stamp for new 52-page catalog. P. Peiffer & Company, 4 Columbia St., Newark, N. J.

**BARGAINS**. Presses, type. List 3c. Exchange, A-27, 222 Columbus, Meriden, Conn.

**INEXPENSIVE** 6 x 9 printing press—details free. Novelty Shop, Downsville, La.

#### PROFITABLE OCCUPATIONS

**RAISE** Rabbits and Cavies for us. Full details. Catalog, contract and magazine 10c. Or send 25c for book, catalog and year's subscription to Small Stock Farmer Magazine. Stahl's, Box 11, Holmes Park, Mo.

**M. M.** Earned \$267 three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3848 Lincoln Ave., Dept. 122, Chicago.

**MONEY** from old inner tubes, 18 plans 25c. Daniels Service, Statesville, N. Car.

#### RADIOS, SUPPLIES & INSTRUCTION

**RADIO** engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Poplar St., Valparaiso, Ind.

**RADIOS**—\$7.95 up; kits—\$3.95 up. Complete. Ready to wire. 5-10 tubes. Save 50%. Catalog—Free. User agents wanted. Marco-E, Kansas City, Mo.

**STANDARD** make radio phonograph combination. Special \$29.95. Formerly \$59.95. Schwarz, 614 Third Avenue, New York City.

**DACO** 1940 catalogue for new and rebuilt precision instruments is available at once. Write now. Dayton Acme Co., 2339 Gilbert Ave., Cincinnati, Ohio.

**"SERVICING Hints"** booklet free. Supreme Publications, 3729 Thirteenth St., Chicago.

#### RARE COINS

**FREE!** Foreign coin, banknote, and large illustrated coin catalogue. Send 4c postage. Coin approvals sent. Tatham Coinco, Springfield-D50, Mass.

**QUICK** Cash for your old coins. We pay big prices for wanted coins; certain 1909 cent, \$10; liberty head nickels before 1914 \$500; 1864, 1865 Indian head cents \$100 each; dimes before 1895 \$600; some worth \$6,000 each. Have you valuable coins in your possession? It will pay you to be posted—Send 15c for our illustrated coin catalog. National Coin Corporation, Uninc. (3), Daytona Beach, Florida.

**COMMEMORATIVE** \$1 1/2. Columbus, Lincoln, Stone-Mountain, Cleveland, \$1.00 each. Retail catalogue 10c. Norman Shultz, Salt Lake, Utah.

**WE** purchase all Indianhead pennies. Purchasing catalogues 10c. Felix Waltman, 460 Grand St., New York.

**ILLUSTRATED** Retail Coin Catalogue 10c. (2300 quotations). James Randell, 407 South Dearborn, Chicago.

**UNCIRCULATED** 1939-S or 1939-D cent and catalogue 10c. Landon, 901-B Lucerne, Los Angeles.

**15 NICE** coins, 25c. Bishoff, 500 E. 8th, Kansas City, Mo.

**THREE** Foreign coins, price list 10c. Joseph Coffin, 1182 Broadway, New York.

#### REFRIGERATION

**BUILD** your own cold-storage. Instructions, material, furnished by 10 yr. exp. ref. Engineer; low prices. Any problem answered, 50c. Write L. Miskella, Box 612, Olympia, Wash.

#### REPTILE PRODUCTS

**XRAY** reproduction rattlesnake skull and catalog free. Headquarters, Rattlesnake, Fla.

#### ROCKS & MINERALS

**BEAUTIFUL** banded Calcite in white, grey, blue and brown markings. Cuts easily, polishes nicely. Five different specimens, about 2 lbs. each, postpaid in U. S., only \$2.00. Louis F. Bedier, Green River, Utah.

**MINERAL** Specimens and books on mineralogy, gem polishing, fossils. Catalog .05. The Gem Shop, Box F797, Helena, Montana.

#### RUBBER STAMPS

**3 LINE** Stamp 25c; cushioned 30c; 2000 business cards \$1.35. Printrite, Wauwatosa, Wis.

**CUSHIONED**. 2 lines 25c. 3-35c. Ours are better! Ad-Crafts, LaCrosse, Wis.

#### SCOTCH TWEEDS

**SCOTCH** Tweeds \$2 yard. Samples dime. Bridge Mill, Galashiels, Scotland.

#### SONGWRITERS

**WANTED**. Poems, to be set to music. Submit for consideration. Transcription records made. Keenan's Studio, PS, Box 2140, Bridgeport, Conn.

**SONGWRITERS**—Write today for free booklet "Building an Income Thru Songwriting." Songwriters Institute, 1234-J Broadway, New York.

**ORIGINAL** poems, songs wanted for immediate consideration, publication. Music Corporation, Dept. N-16A, Portland, Ore.

**FREE**, inspiring booklet describing songwriting opportunities. Allied Music, Dept. 5, Box 507, Cincinnati, Ohio.

**SONGWRITERS!** Words, melodies. Amazing offer. Hibbeler, C-15, 2157 No. Avers, Chicago.

**SONG** Poems wanted. Free examination. McNeil, Master of Music, 510-PS South Alexandria, Los Angeles, Calif.

**SONGWRITERS:** Send your poem today for immediate consideration. Richard Brothers, 146 Woods Bldg., Chicago.

#### SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY

**FISHERMEN**—Get a genuine Richardson Rod—priced and built to fit your requirements. Sturdy light-weight construction, "just right" flexibility and balance make these rods universal favorites. Bait and fly casting; trolling and weakfish rods. One-piece solids, the new hexagon seamless tubulars with offset handles, jointed tubulars, and telescopes, each tagged with the "Sign of the Fish" giving details of construction. Write for thrilling 1940 catalog. Richardson Rod and Reel Company, 3179 N. Sawyer Ave., Chicago, Ill.

**SLEEPING** Bags—Make your own. Very inexpensive. Detailed instructions, drawings, 25c. Western Research, R.F.D. 210, Mill Valley, Calif.



**HUNTING**, fishing, trapping, outdoor equipment, used guns. List and catalog free. Howe Fur Company, Coopers Mills, Maine.

**ARCHERY** Supplies. Instruction book and catalogue 10c. Mid-West Archery, 2209-D East 75th, Chicago.

**TENNIS** Restrainers: frames, gut, silk. Free catalog. Tennis Supply, 1407 1/2 Sixth Avenue North, Minneapolis, Minn.

**FLY-TYING** instructions and materials. 15 flies 25c. Wolfgram, 315 Chicago Ave., Wausau, Wis.

### STAMP COLLECTING

**"HORRORS Of War"** Packet! Thrilling stamps picturing horrible war scenes: Ukraine "death stamp" depicting "Grim Reaper;" Azerbaijan (food for dead men!); Portugal (slaughter of an army); Bulgaria (soldier with drawn bayonet); Norway (battle scene one thousand years ago); also modern nations at war—China, Poland, Mongolia; many others. Extra for promptness: Pocket stock book and scarce set from Asiatic war countries, cataloging over 50c! All for 5c to approval applicants! Jamestown Stamp Co., 227 Wellman Bldg., Dept. 5, Jamestown, New York.

**GIANT** packet 200 all different from Africa, South America, Asia, South Sea Islands, etc. Includes world's smallest stamp; triangle and diamond-shaped stamps; animal stamps, Nicaragua "Will Rogers" airmail; many others. Also packet 17 different United States (cataloging 50c); all obsolete, including \$4 denomination, commemoratives, etc. Total catalogue price over \$5.00! Everything for only 5c to approval applicants! Mystic Stamp Company, Dept. 55-N, Camden, New York.

**STAMP** Outfit free! Scarce airmail triangle from the Mozambique Co.; genuine North Borneo (Buffalo Transport); fine packet Jungleland Countries only (a real thriller) including Sarawak (White Rajah), Belgian Congo, Perak, Sudan (Desert Scene), etc., also set U. S. stamps (50 years old!) and extra Surprise Gift—this big outfit absolutely free with dandy approvals and lists! Send 3c for postage. Midwood Stamp Company, Dept. 5R, Midwood Sta., Brooklyn, N. Y.

**FREE!** The Stamp Finder! Send today for big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants including 3c postage. Garcelon Stamp Co., Box 918, Calais, Maine.

**NEJD** (Saudi Arabia)—Bolivia Eucharistic Triangle, Cayman Island Pictorial, Negri Sembilan, Turks & Caicos Islands, Manchukuo, Bahamas War Provisional, Five Dollar United States, British Solomon Islands (Cannibalism). Everything 3c with our famous approvals. Viking Stamp Co., 1-P Hanson Place, Brooklyn, N. Y.

**15 DEAD** Countries—1867 Thurntaxis, British Colonials, Czechoslovakia, Danzig, 12 others no longer issuing stamps, 10c; Nude Duchess, Hindenburg Zeppelin, Transatlantic airmail commemorative, 5c. Approvals sent. Both lots 13c. Laurence Shultes, Berne, N.Y.

**WORLD'S** Smallest airmail - largest map diamond and triangle stamps, free stamp magazine, magnifier to study stamps, with large packet of stamps from many countries. A bargain 5c with approvals. Capital Stamps, Dept. 10, Little Rock, Ark.

**GIFT** Edition stamp annual free. Sixty pages with hundreds of illustrations featuring Canadians, Newfoundlands, United States, Colonials, foreign, supplies. Sent free. Gray Stamp Co., Dept. PR, Toronto, Canada.

**SCARCE** Diamond airmail! Wonderful packet 115 different from strange countries. British Colonials, Haiti, Tasmania, pictorials, etc. 5c to approval applicants. Reliable Co., Dept. 8, Box 139, Church Annex, New York.

**SIX** dollars for 9c! 300 different stamps (Cat. price \$6.00) only 9c with approvals. Tatham Stamp Co., Springfield-50, Mass.

**ALL-AMERICAN** Bargain approvals: Applicants given 100 different South-Central American collection for 10c. Without approvals 25c. Davis, (APS), Silver Lake, Ind.

**FREE!** Select 10 stamps from our approvals free. Just send names, addresses 2 active collector friends. Ranger Stamp Co., Dallas, Texas.

**SENSATIONAL** Offer! 24 Different Mexico includes giant diamond airmail, complete new printery set, 5c with approvals. Stanley Melzer, 3120 South Adams Ave., Milwaukee, Wisconsin.

**COLLECTORS:** Fine United States and foreign stamps including airmails, commemoratives, postage on approval. Harvard Stamp Co., 318 Harvard St., Brookline, Mass.

**50 DIFFERENT**, fine U. S. including perforation Gauge, 10c with approvals. The Stamp Shop, 813 Holland Building, St. Louis, Mo.

**NEWFOUNDLAND**, 200 well mixed including commemoratives and latest issues, \$1.00. George Cobb, Bay Roberts, Newfoundland.

**200 DIFFERENT**, 5c! includes worldwide variety, scenic, commemoratives, airmails, pictorials. Approvals. F-S Company, Box 2154, Houston, Texas.

**GIANT** world selection. All different. Only 10c to approval applicants. Rose City Stamp Co., S-310 Rector Bldg., Little Rock, Arkansas.

**ELUSIVE** Imperforate triangular miniature sheet with 100 different stamps—10c. Friendly Philatelists, Box 4428P, Philadelphia, Penna.

**MEXICAN** \$20 bill and 10 different Finland stamps 10c. Nagles, 346 North 12th, Reading, Penna.

**100 DIFFERENT** Roumania 25c, approval applicants. Hermes Stampco, Box 276, Hempstead, N. Y.

**FORTY** Country mixture, including scarce Fiji, 300 stamps, 25c. Elzea, Bowling Green, Ohio.

**50 FREE**, Iraq, Iran, etc., Catalogued \$1.00. Album 3c. Bullard, 268D Northampton, Boston, Mass.

**1940 WHOLESALE** catalogue Free—Eighty pages. Empire Stamp, Dept. 19, Toronto, Canada.

**25 SETS:** 100 large unused stamps only 25c with approvals. Empire State Stamp Co., St. Johns Station, Brooklyn, N. Y.

**200 ALL** different stamps with approvals, only 4c. Ensign Stamp Co., Gardner, Mass.

**UNITED** States coil stamps, eighteen varieties, 10c. Goldsmith, Box 200-H, Chicago.

**140 BOLIVIA**, Niger Toga, Somalis, Grenada, Palestine, etc. 10c. Lufbery, Middletown, Conn.

**1000 STAMPS** different foreign \$1.25, 100 airmails \$1.25. Philatelic Headquarters, Trenton, N. J.

**EXCHANGE** your duplicate stamps. List, Swappers, dime. Registrar, Box 2166, Denver, Colo.

**FREE!** Royal visit packet. Postage 3c. Roberts, 312U Shearerbldg., Baycity, Mich.

**STRAITS** No. 72 catalogues 45 cents each 12 cents plus postage. Max Scheinfeld, 28 Beach Road, Winthrop, Mass.

**UNPICKED** Mixture: 40c pound, 100 U. S. revenues on documents—10c! (700—50c). Vanvoorheis, Hyndman, Penna.

**300 U. S.** Postage, 150 varieties. Only 58 cents. Jungkind, Box 806PS, Little Rock, Ark.

**UNITED** States approvals—try us once and be satisfied always. Seminole Stamp Studio, Box 416, Miami Beach, Fla.

**FREE!** Illustrated price list with perforation gauge. Shoenbach's, 425 West 57, New York.

**1000 MIXED** foreign, 25c. Well worth sorting for values. Plaza Stamp Co., Santa Fe, New Mex.

**PENNY** approvals. Thousands different. Pictorials, commemoratives. Raymax, Station Y (21-X), Brooklyn, N. Y.

**1000 MIXED** U. S., including commemoratives, precancels, 15c. Lee, Bridgeport, N.Y.

**PENNY** Approvals that please. Haywood, 395 Adams St., Pomona, Calif.

**PENNY** Approvals by country. M. H. Hoerning, Merriam, Kansas.

**FREE** Treasure Packet. 3c please. Oromocto Stamps, Kitchener, Ont., Canada.

**6 SETS!** 3c to serious approval applicants. Stamps, E. Rochester, N.Y.

**25 DIFFERENT** Latin America only 10c. Burkhart Stamps, Sandwich, Ill.

**72 DIFFERENT** U. S., 10c. Album Service, Route 57-10, Sioux City, Iowa.

**UNITED** States stamps on approval. Southern Stamps, Box 70, Miami, Fla.

**DEAD** Country! 100 specially selected Poland. Only 10c with approvals! Saxon, 408-B Jay St., Brooklyn, N.Y.

**175 MIXED** stamps 5c with approvals. Dawson, 1308F, The Dalles, Oregon.

**PENNY** Approvals that satisfy. Neil Gronberg, Box 5441S., Philadelphia, Penn.

**APPROVALS**. Large selections, low prices. HKeigwin Stamp Co., Vineland, N. J.

**PERU**—30 Airmail \$2.00. Try. Write today. Mutze, Lima-Peru, Ap-1553.

**5 TRIANGLES**, 100 World, 10c. Approvals. Ransom, 1333 Pontiac, Ann Arbor, Mich.

**PALESTINE** 7 pictorials 3c approvals. Ira Rogers, R. 2, Grand Rapids, Mich.

**FREE!** Austria war set. Postage 3c. Williams, 601 Archerbldg., Baycity, Mich.

**150 GOOD** mixed foreign stamps, 5c coin. Stanton, Niantic, Conn.

**THREE** sets for three cent stamp! Jack Reed, Houtzdale, Penna.

### TATTOOING SUPPLIES

**TATTOOING**. Engraving. Outfits. Illustrated list free. Percy Waters, Anniston, Ala.

**TATTOOING** and engraving machines. Jensen, 412 South Main St., Los Angeles.

### TYPEWRITERS, OFFICE DEVICES

**TYPEWRITERS**, adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

### WANTED—MISCELLANEOUS

**CASH** for used microscopes, binoculars, slide rules, drawing sets, scientific instruments, tools, cameras. Satisfaction guaranteed or shipment returned. Elman's, 2300-PS VanBuren, Chicago.

**WANTED**—False teeth, Crowns, bridges, gold, platinum, jewelry. Goods returned if price is unsatisfactory. Western Metal Co., Bloomington, Ill.

### WATCHES

**WATCH-REPAIRING** is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Company, E-2005 Manhattan Bldg., Chicago.

**WATCHMAKERS'** Materials; tools; watches; jewelry. Bought, sold, exchanged. Wholesale catalogue. Ben Segal Company, Mellers Bldg., Chicago.

**WATCHMAKERS'** Supplies, tools, parts. Write for price list 44. Dean Company, 87 Nassau St., New York.

### WELDING, SOLDERING

**D.C. ARC-WELDER** plans \$1.00 each (three for \$2.00). Build it yourself without rewinding armature. 25-200 amperes from farm light plant generators. 25-200 amperes from Northeast, Dodge automobile generators. 25-600 amperes from d.c. vehicle motors originally storage battery driven. Welders Club, WB-3432 M-Mart, Chicago. For Sale: D.C. vehicle motors, supplies, etc.

**BARGAINS**. Demonstrator Arc Welders, gasoline and electric drive. Liberal trial, easy terms. Write Hobart Welder Exchange, Box P-5402, Troy, Ohio.

**BUILD** AC welder to cut or weld. Plans for three sizes, \$1.00. Information dime. Hi-Point Electric Products, Bellefontaine, Ohio.

**COMMONWEALTH** Electric arc welder complete. Schwarz, 614 Third Avenue, New York City.

**WELDING** outfits \$27.73; Electric welders, \$49.68. Superior Oxy-Acetylene, Hamilton, Ohio.

**WELDERS**, new and used. Write Lincoln Electric Company, Cleveland, Ohio.

**110-220 VOLT** arc welders, helmets, plans, material. Holgerson, Canton, Kansas.

**VEHICLE** generator, 300 amp. Welder \$30.00, 1323 Virginia St., Elizabeth, N. J.

### WIND ELECTRIC PLANTS

**BUILD** electric plant operated by wind. Complete plans and catalog 10c. Welders, fencers, burglar alarms, motors, radios, appliances. Send dime today. LeJay Mfg., 423 LeJay Bldg., Minneapolis, Minn. **FREE** Electricity from wind. Build your own windcharger. Cost 98c for material plus used car generator. Drawings—instructions 10c. Wesco, Minneapolis, Minn.

### WOODS

**"A Hobby That Pays"**! For suggestions, selling plan, index list, six specimen woods—send 25c to Woodcrafters Guild, Dept. 17S, L.I. City, New York.



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END OF THE  
RUN!

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JOHN F. ELLIOTT, Fireman  
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Every pipe of Velvet is scheduled to smoke *right* . . . made from finest Kentucky Burley tobacco in America's most up-to-date tobacco factory. Velvet's the right word for smooth smoking . . . that means it's mild and cool . . . "no bite."

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# Velvet

*the Right Word  
for Smooth Smoking*

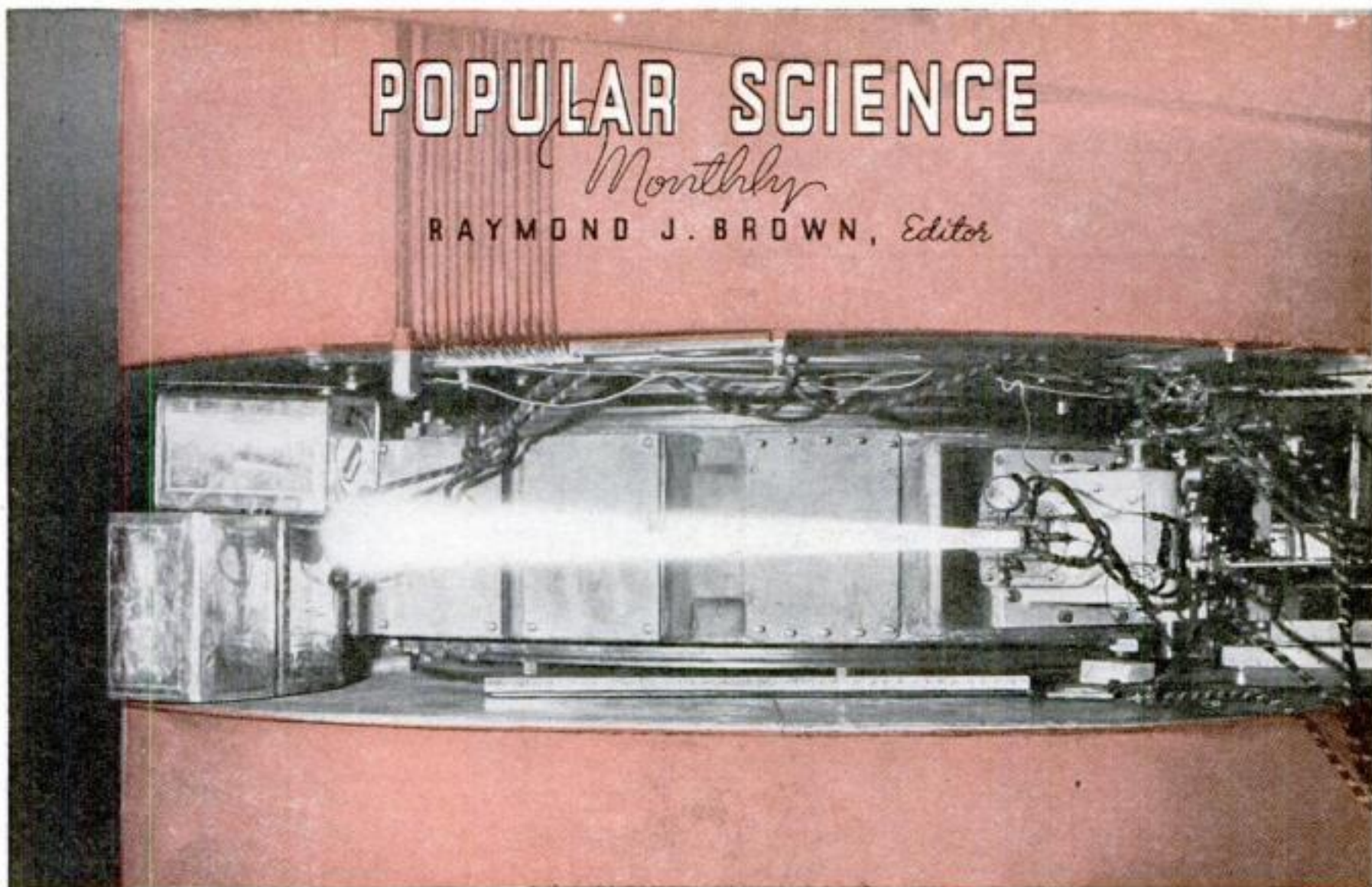
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# POPULAR SCIENCE

*Monthly*

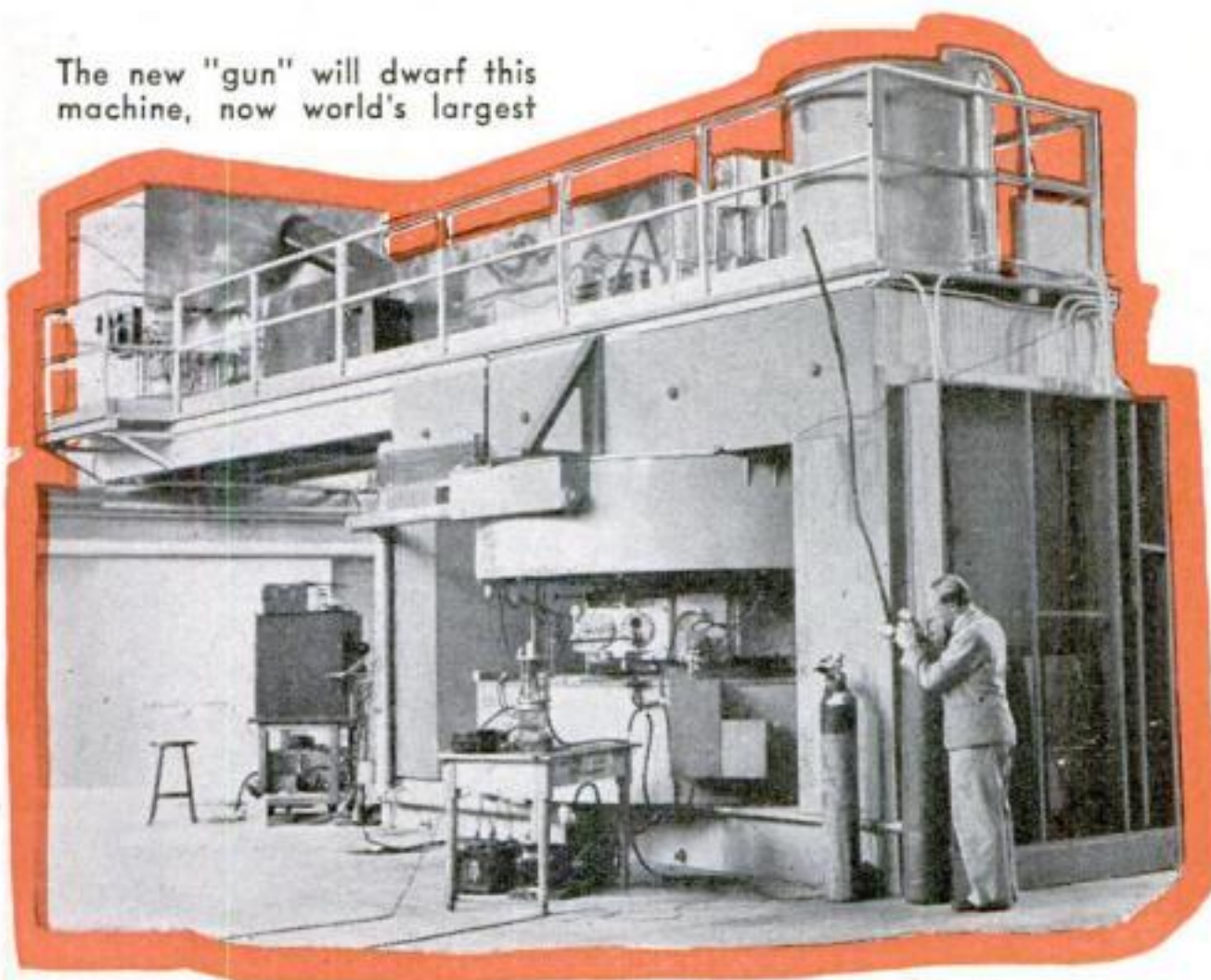
RAYMOND J. BROWN, *Editor*



Deadly blue rays streaming from the muzzle of the 200-ton cyclotron at the University of California

## GIANT ATOM GUN TO HELP FIGHT DISEASE

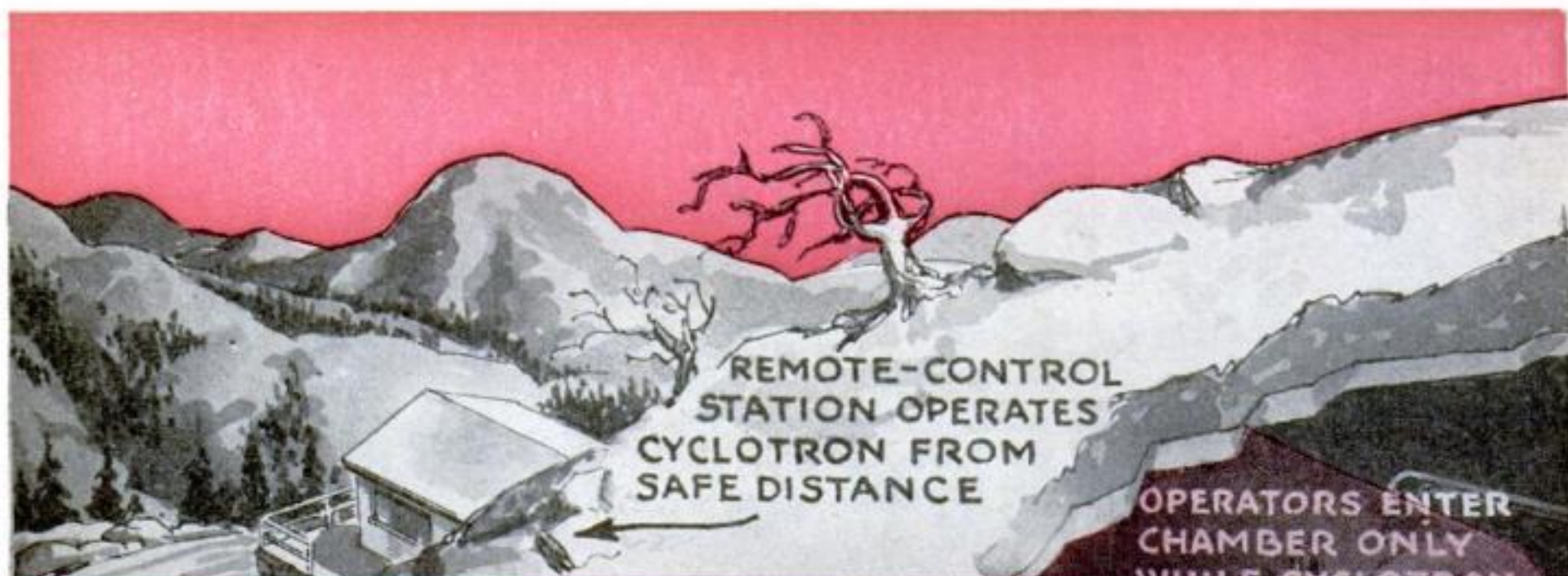
The new "gun" will dwarf this machine, now world's largest



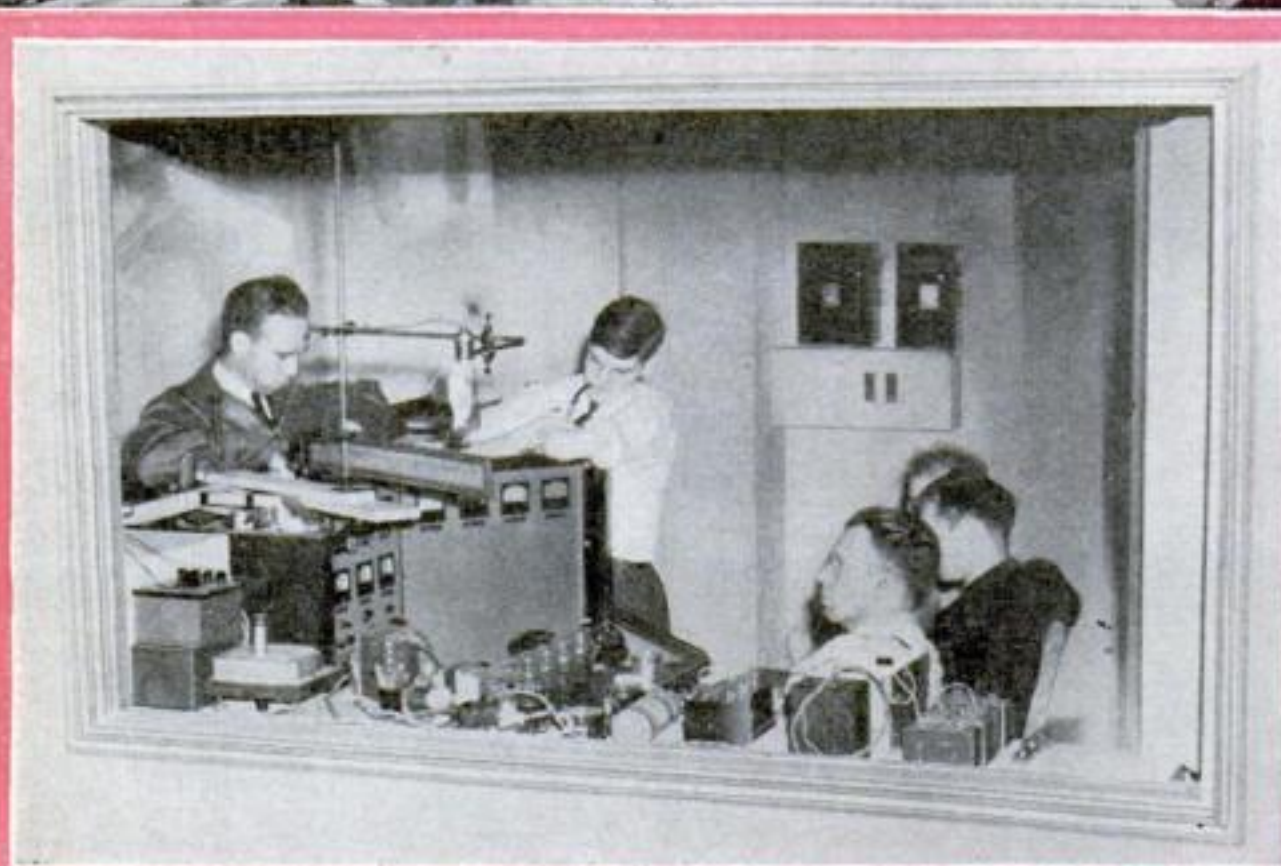
**S**TREAMING fanwise from between the poles of the world's largest magnet, dazzling blue rays, packed with more energy than all the radium ever mined, soon may pour out of a colossal electric "machine gun" so powerful that it must be located in an isolated spot and operated by remote control.

Completely surrounded by tanks of water and buried in a hillside to guard against stray radiations, the giant "cyclotron" would be almost as large as an ordinary five-room house. Its weird blue radiations would be focused upon a target placed in a vacuum chamber, and its tremendous energy used to produce amazing,





OPERATORS ENTER CHAMBER ONLY WHILE CYCLOTRON IS NOT RUNNING



From the control room of the present "atom gun," scientists can watch the operation of the huge machine while shielded from its radiations

miraculous changes in ordinary substances like table salt and lead.

Only its cost of \$750,000—the price of three bombing planes—is delaying its construction. By the time these words are in print, the huge generator may be taking shape at the University of California. Plans were being drawn even as its proponent received word, late last November, that he had been awarded the Nobel prize for development of the decade's most revolutionary instrument in atomic research.

Ten years ago the cyclotron was but a fantastic scheme in the mind of a young professor at the University of California. Like others, Dr. E. O. Lawrence had toyed with the idea of smashing the atom by hurling a stream of minute bullets at it. He knew that radium, in its strange, centuries-long process of disintegration, hurls out positively charged particles with peculiar powers. Under their bombardment, atoms broke down and substances underwent remarkable transformations. Now, if he could speed up the process by generating billions of such particles, shooting them at terrific speed, the alchemist's dream of transmuting base metals into gold might be realized.

Some experimenters had tried it already, firing smaller-than-atom particles by huge electric discharges of 5,000,000 to 10,000,000 volts. But these electric machine guns could not be controlled—they flared thunderously for an instant, leaving behind a tangle of wrecked,

1 Generator supplies power at high frequency and voltage.

2 Copper pipes shield transmission cables to cyclotron.

3 Cylinders contain tuning apparatus.

4 Electric power energizes D-shaped electrodes alternately.

5 Power also heats tungsten filament.

6 Hydrogen atoms, piped to tip of filament, receive electric charge.

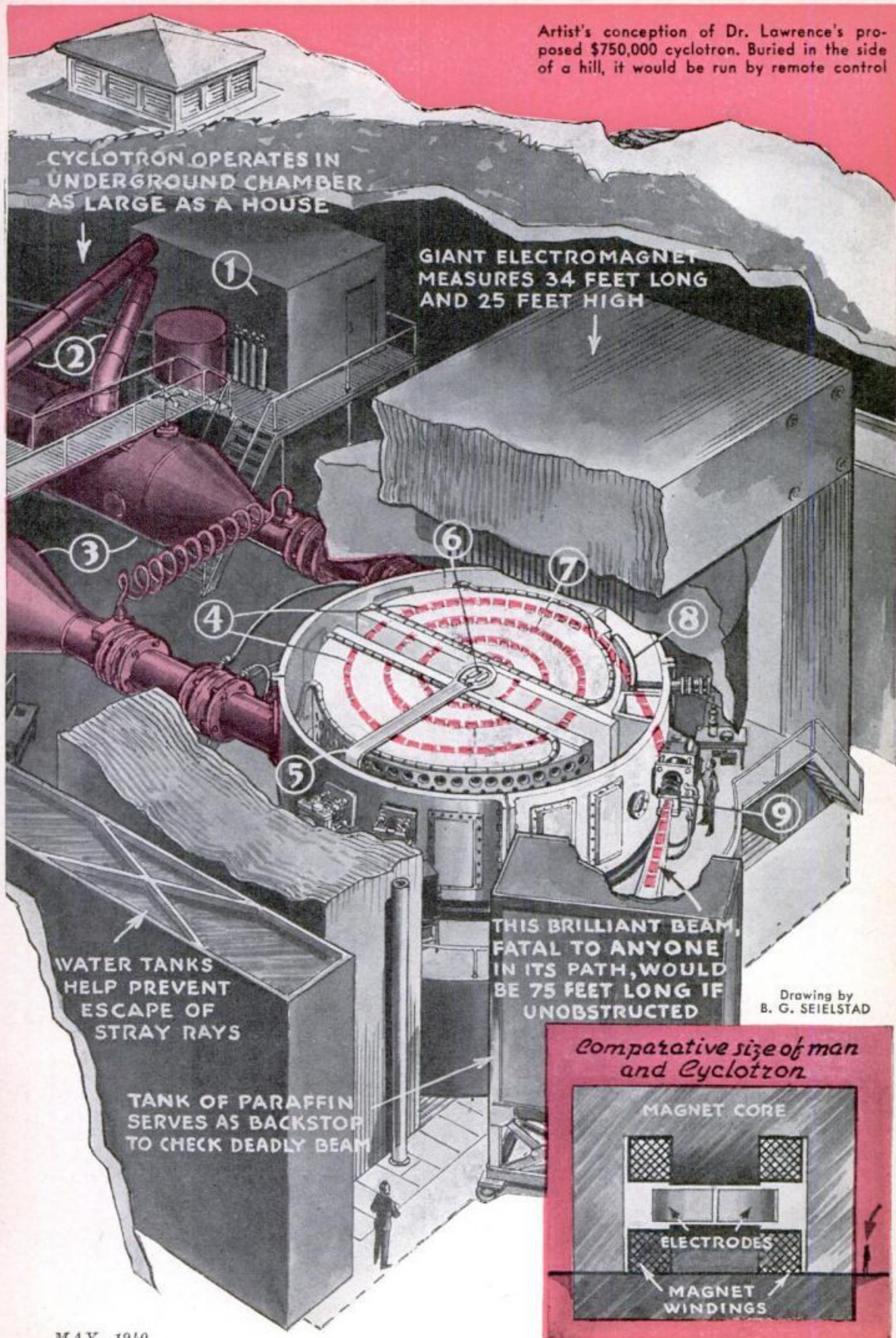
7 Timed "kicks" from electrodes propel charged hydrogen atoms in spiral path.

8 Charged deflector plate guides stream of atoms to outlet.

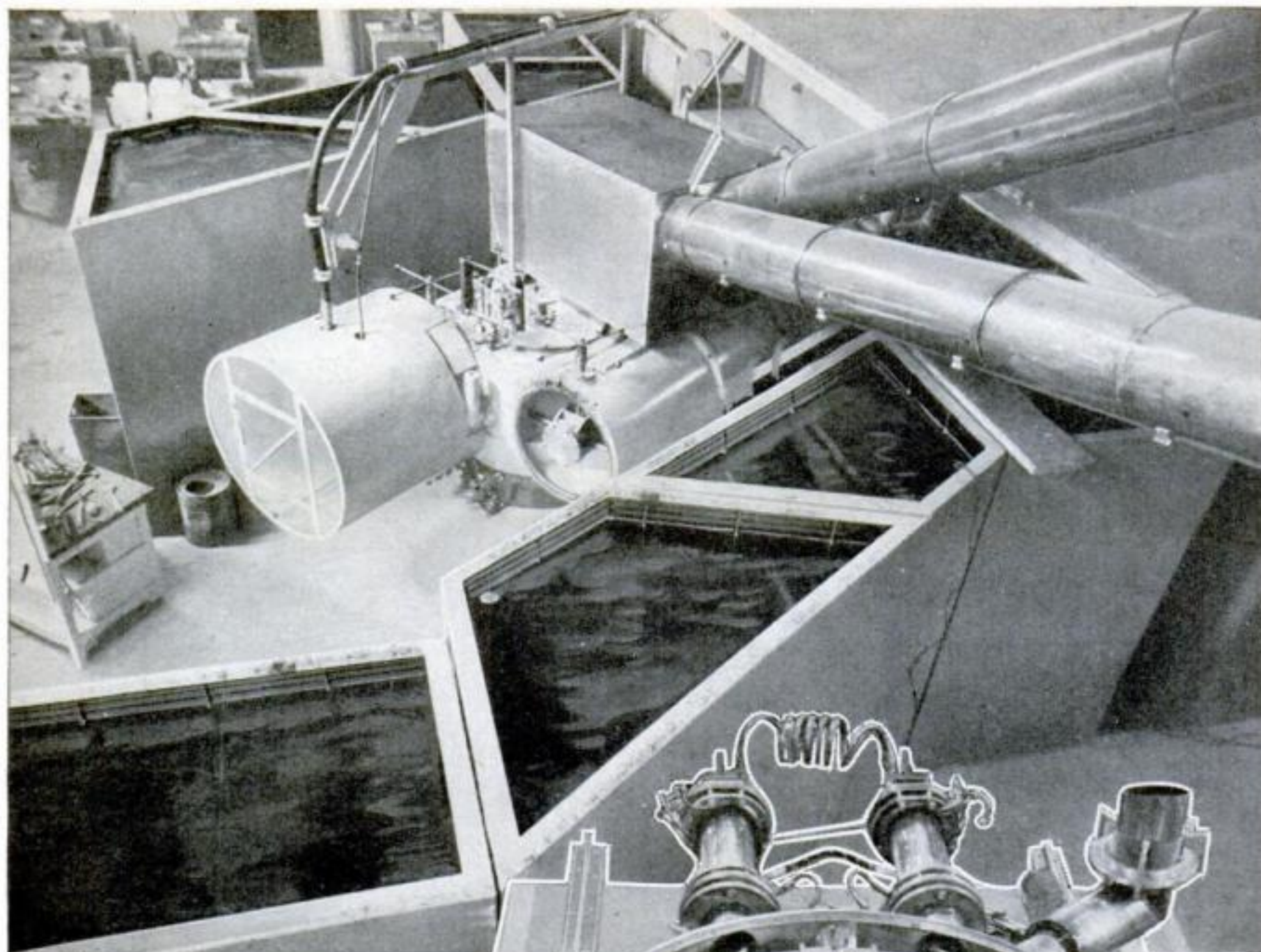
9 100,000,000-volt particles bombard material in chamber.



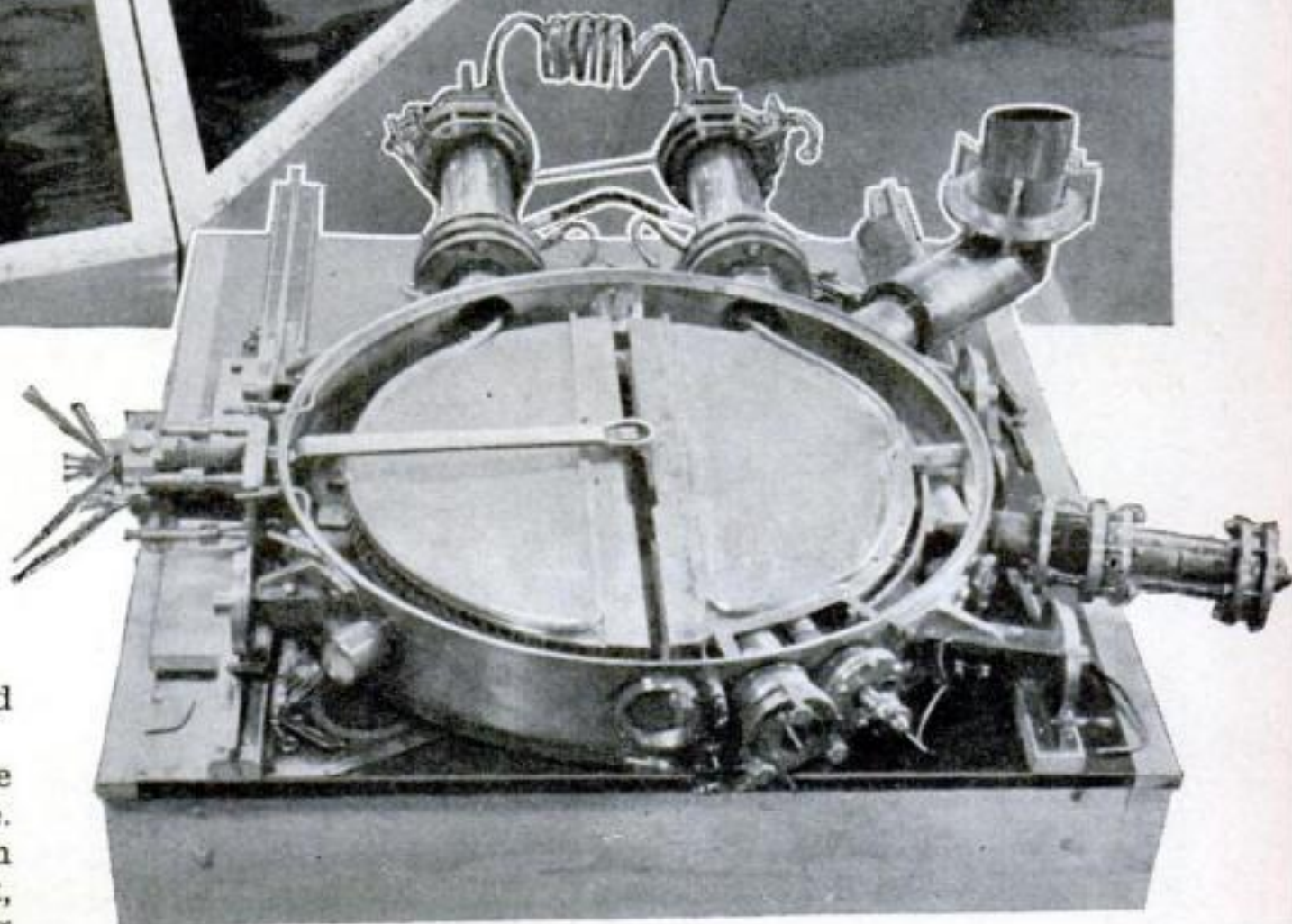
Artist's conception of Dr. Lawrence's proposed \$750,000 cyclotron. Buried in the side of a hill, it would be run by remote control







Water tanks surround the 200-ton atom smasher. At right is the heart of the machine, the "frying pan" in which particles of matter are whirled at terrific speed and hurled outward



smoking equipment and shattered insulators.

Dr. Lawrence's scheme was fantastic, yet simple. Whirl the particles as if in an old-fashioned slingshot, round and round, adding force at each revolution; then let go, sending the shot whizzing out with the cumulative energy of all the revolutions. For the sling he would use a large magnetic field; for wrist power he would substitute a high-power radio-frequency oscillator. Securing an eighty-five-ton electromagnet originally designed for an arc radio transmitter for the Chinese Government, he demonstrated the soundness of his scheme so sensationally that it led at once to the building of a 200-ton instrument which even now, in the hands of the laboratory's research staff of twenty physicists, is making history at the University of California. It will fire bullets with an

energy far greater than most lightning flashes, projecting bits of matter at a velocity of 25,000 miles a second—fast enough to travel to the sun in an hour.

This amazing speed is made possible by a method of electrical timing resembling an automobile ignition system. At the heart of the cyclotron is a closed vacuum chamber shaped like a huge copper frying pan, nearly filled with two big, flat, D-shaped electrodes. Down the center runs a tungsten filament. Fat hydrogen atoms obtained by electrically decomposing "heavy" water (imported from Norway at ninety-five cents a



gram) are squirted into the pan. Sizzling against the hot filament, they are "ionized" into fragments which instantly are seized by the electric and magnetic field and sent spinning on a circular path. Just then a powerful short-wave transmitter delivers a 400,000-volt kick across the D's, giving a tremendous boost to the racing particles.

Halfway around the circle, another shock, nicely timed, adds again to their speed. Forty times around, the energy multiplied eighty times, and out they fly through a window of paper-thin aluminum. Substances to be bombarded are put into a small vacuum chamber which is bolted onto the very muzzle of the big gun.

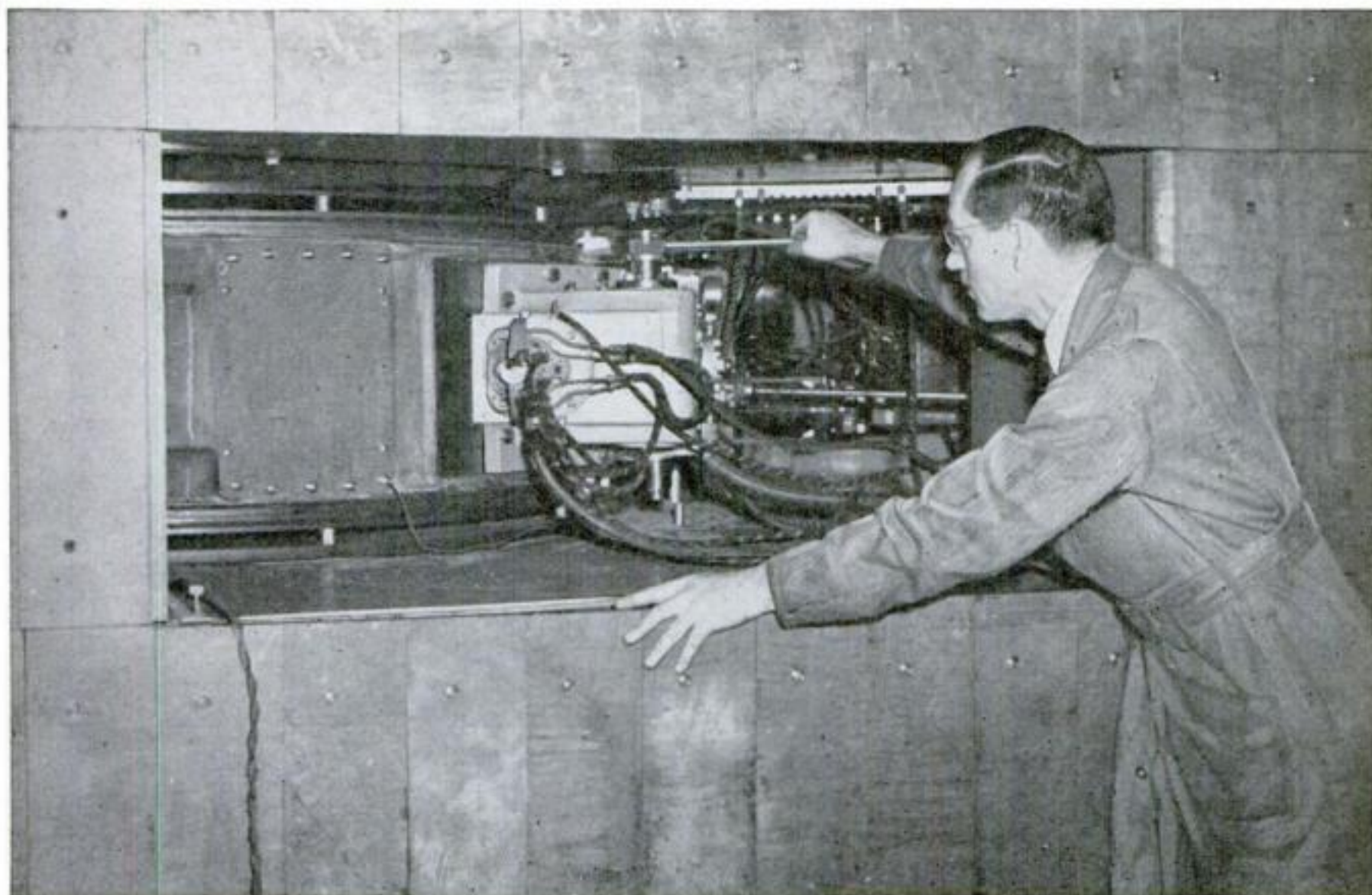
**B**UT this machine, now the world's largest, will seem a mere pygmy beside the giant Dr. Lawrence hopes to build. When this is done and the experimenters use their 5,000-ton machine gun to fire at atoms as a farmer uses a shotgun to pepper away at crows, two kinds of hits are possible. If they hit a platinum atom squarely, for instance, they may turn it into gold by loading it full of "slugs," thus raising its atomic weight. But if they shoot away part of an atom, still another new substance results. Shattering an atom of lithium, lightest of metals, converts it into the gas, helium. Most bullets miss, but the success of the gun lies in the fact that they are poured out at the rate of 5,000,000 billions a second. Yet they are so small

that several million millions of them could be fired into the point of a pin, without hitting the same spot twice!

Cyclotron experts don't expect to revolutionize industry by making precious metals in the laboratory on a commercial scale. When they turn a common metal into gold, for instance, they do not get pure gold, but a mixture of the two. Chemical tests show the gold to be just as real as gold from the mine—but to keep on shooting until all the atoms were hit and the whole piece turned to gold, would take many years and so much power that you could mine the gold much more cheaply. Besides, why waste this energy making a metal worth only thirty-five dollars an ounce, when you can produce the equivalent of the rarest of metals, worth hundreds of times as much?

Physicists say a gram of radium—a piece about three times the size of a pinhead—shoots out thirty billion particles a second; but the big cyclotron will emit 5,000,000 billions! Radium's bullets go out in all directions and are largely wasted; but the cyclotron concentrates all its tremendous energy into a slot about the size of a man's thumb, and its energy corresponds, not to a gram, but a *ton* of radium—many times the amount that has been mined in nearly half a century since its marvelous powers were discovered.

Still more sensational is its amazing ability to create new *(Continued on page 225)*



Bolting the target chamber, containing material to be bombarded, to the muzzle of the atomic machine gun





Ward T. Van Orman and his air-conditioned leg cast which his discomfort led him to devise. Below, his nurse watches the gauge that tells if too much air is used

## Plaster Casts Get Air Conditioning

BREAKING his hip may have been a break in more ways than one for Ward T. Van Orman, world-famous balloonist of Akron, Ohio. Lying with his legs incased in a plaster cast, Van Orman decided that something should be done to make the heavy cast comfortable. So he had a rubber tube introduced into the cast and connected to an air pump so that cool breezes could be forced in to "air-condition" his healing joint. The force



of the air was determined by a bedside pressure gauge, which the patient-inventor himself consulted as a guide to adjusting the air flow. Surgical-appliance promoters promptly made a bee line to his bedside.

## Odd Treatment Rotproofs Fence Posts



Preservative poured in the inner tubes soaks into the ends of the posts

TO PROTECT wooden fence posts from decay, the Forest Products Laboratory at Madison, Wis., has developed a simple, inexpensive method of impregnating the posts with a chemical preservative. Old automobile-tire inner tubes are sliced through, and an open end is fastened around one end of a post. When zinc chloride, a decay preventive, is poured into the tube, the wood slowly absorbs it. Because American farmers are said to use half a billion fence posts a year, this simple process is expected to prove of great value.



# Seaplane Pontoons Get Landing Gear



Ready for a runway take-off on the new wheeled pontoons. Right, close-up of metal skid on pontoon bow to prevent nosing over

PONTOONS equipped with a center wheel and a special metal skid on the front enable seaplanes to make emergency landings on the ground. Made of extremely strong but flexible metal, the pontoon skids, one of which is pictured at the right, keep the plane from tipping forward when the seaplane sits down on its two recessed wheels.

## The World's Softest Job —But It's Hard Work

WALKING on mattresses is the odd way that Harmon F. Rumzie, of New York City, earns his bread and butter. Employed by a manufacturer of high-grade mattresses, Rumzie's job is to break in spring types by strolling over them in his stocking feet. Thirty, ten, and two minutes are required to soften up hard, medium, and soft types.



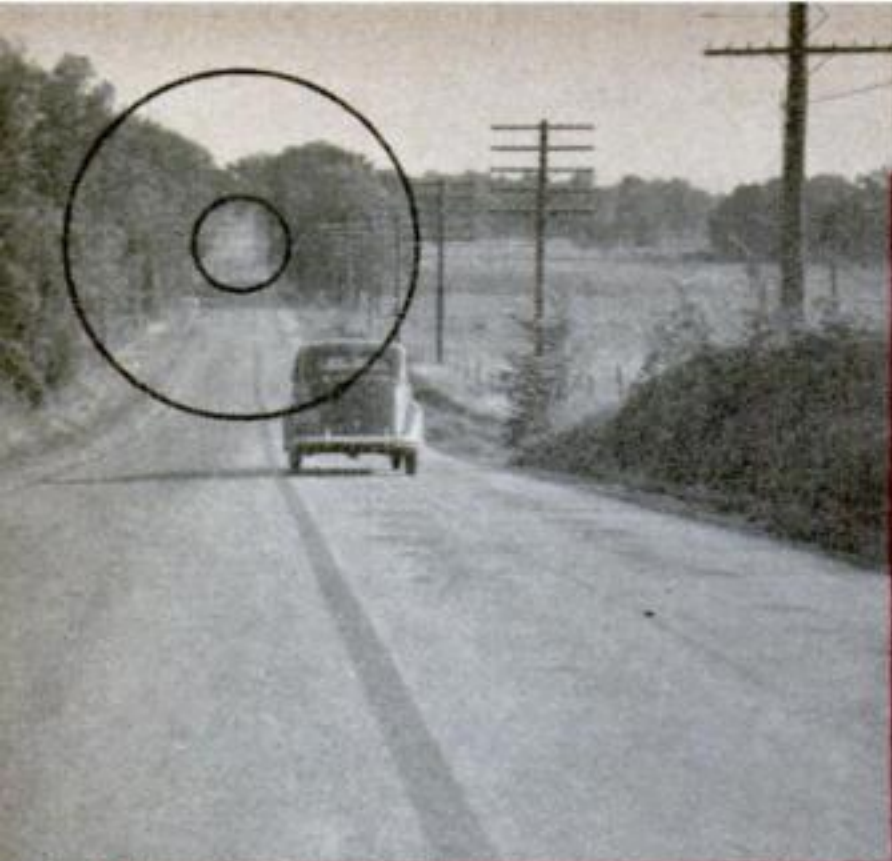
Work keeps him stepping! He's a mattress softener



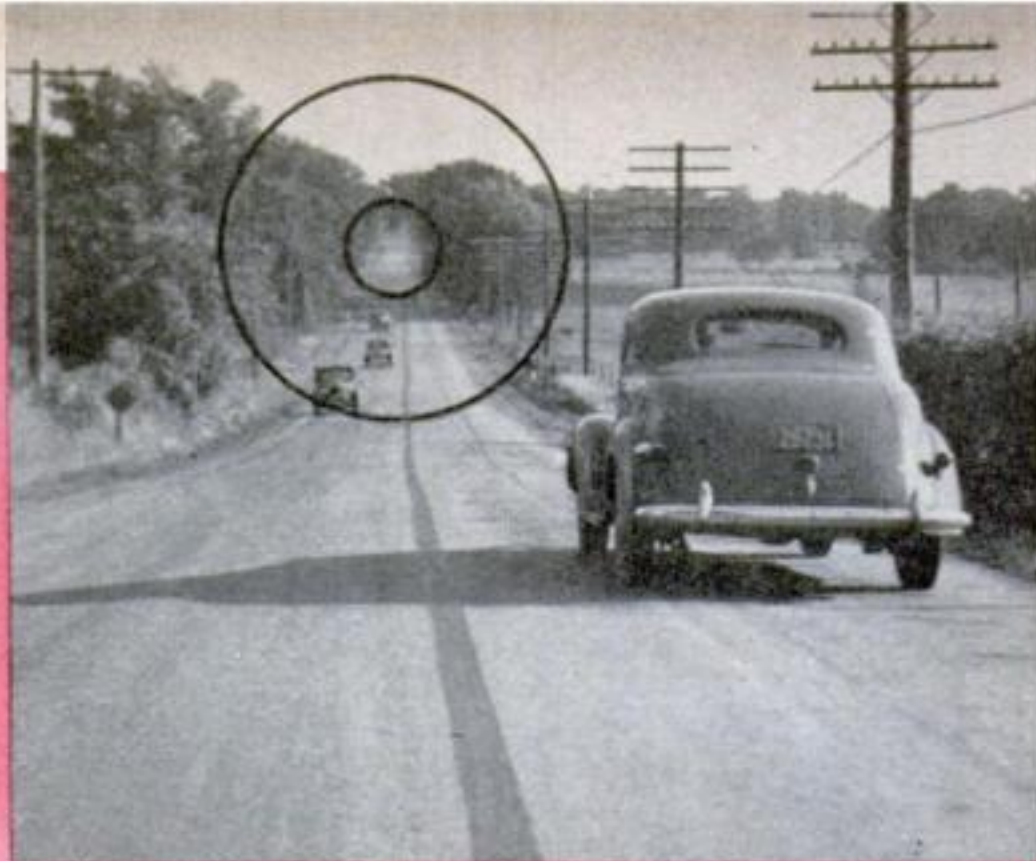
## System Forecasts Arrival of Night Fog at Airport

CULMINATING nearly a year of weather-map study, Joseph J. George, Eastern Air Lines meteorologist pictured above, has discovered a method for accurately forecasting the hour at which nighttime fog—if any—will roll in at the Atlanta, Ga., airport. Of incalculable aid to flying, the system is said to operate with equal efficiency at almost any point in the United States fifty miles or more inland and where the terrain is not mountainous. The system employs a graph-like chart read with the aid of data available daily from the U. S. Weather Bureau.



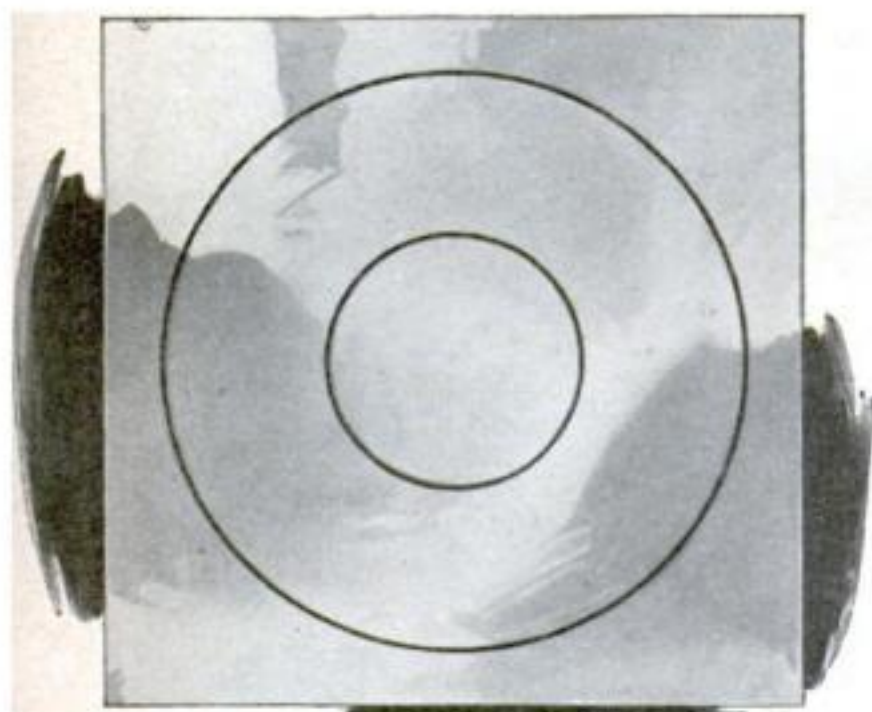


How the "danger meter" is used. Here the road, at the farthest point visible, lies inside the small circle. It is safe to pass



Now, you can still see far enough ahead for safety, but there are oncoming cars outside of the smaller circle. Don't try to pass until the road ahead is clear

# Make a "Danger Meter"



This is what the "danger meter" looks like. It is a square of celluloid, on which two concentric circles are drawn with India ink. Size of the circles depends on the distance from your eyes to the windshield, in accordance with tables on page 56. It is affixed to the windshield as illustrated below



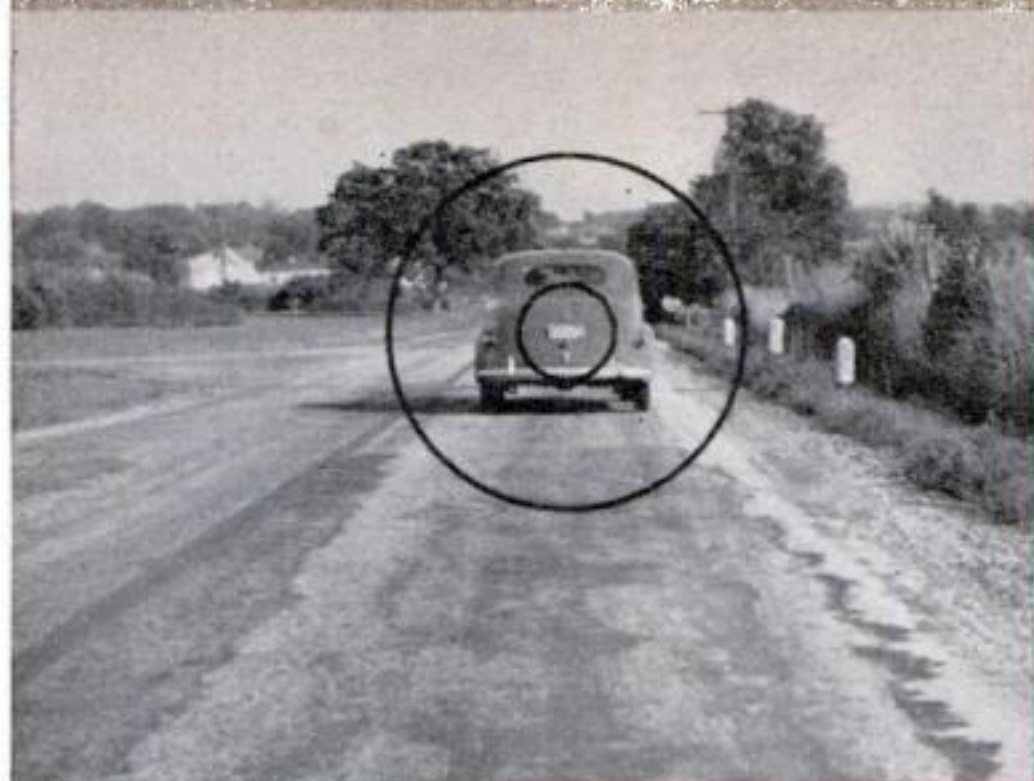
"AM I following too closely behind that car? Would it be safe to try to pass him now?" How often, while driving, have you asked yourself those questions? The accuracy of your split-second decision may mean the difference between safety and a disastrous wreck. Here is a simple "range finder" that you can make and put on your windshield to help you estimate distances and cultivate sure-fire judgment.

Passing a slower car on the road, when another car is coming toward you, calls for accurate judgment. It is a matter of split-second timing. Meeting at a mile a minute each, cars eat up the distance between them at the rate of 176 feet a second. If a driver going sixty miles an hour attempts to go around a car going forty, the swing-out, the passing, and the swing-back will take seven and one half seconds, even though the swing-out is started only 100 feet behind and the cut-in is completed 100 feet ahead of the slower car. In those seven and one half seconds the meeting cars will have traveled 1,320 feet toward each other.

In other words, if a driver travels at sixty miles an hour, he must have a quarter of a mile of clear road ahead before it is safe to try to pass a slower car. It is reasonable to expect a sixty-mile-an-hour speed in the cars that come toward you on the roads outside the cities. At slower speeds, the danger is proportionately less.

Curves, hills, and night driving cause most head-on collisions, because many drivers attempt to pass at times and places where





Judging safe distance for following. If the car ahead looks smaller than the large circle of the "danger meter," you have a margin of safety for sudden stops



If you see this, you're much too close. The car ahead now looks larger than the large circle. This means that you are less than 100 feet behind the car—too close for comfort if the driver should happen to slam on the brakes

# for Your Car

By  
**WILLIAM F. STEUBER**

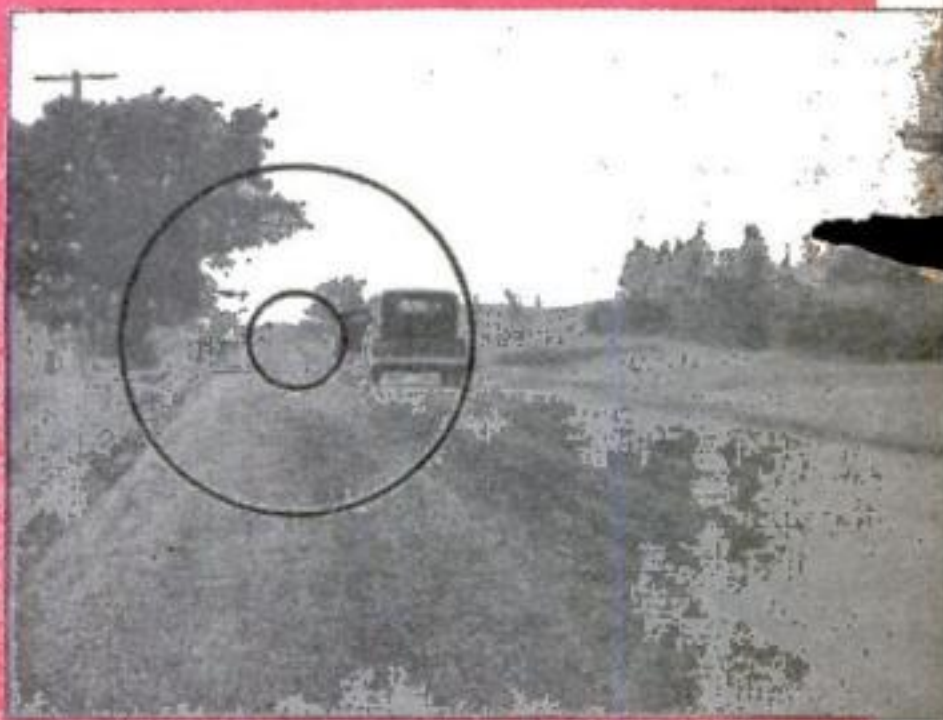
SAFETY DIVISION, MOTOR VEHICLE DEPT. OF WIS.

they cannot see far enough ahead to be sure they have room to use the left lane before an approaching car is upon them. To give the driver a means of judging whether he lacks that necessary quarter mile of clear road is a purely mechanical problem.

The farther away an object is, the smaller it appears. In fact, we estimate how far distant an object is by noticing how large it looks. This use of perspective is the basis upon which you can make a "danger meter" to tell you when it is safe to pass the slower car ahead.

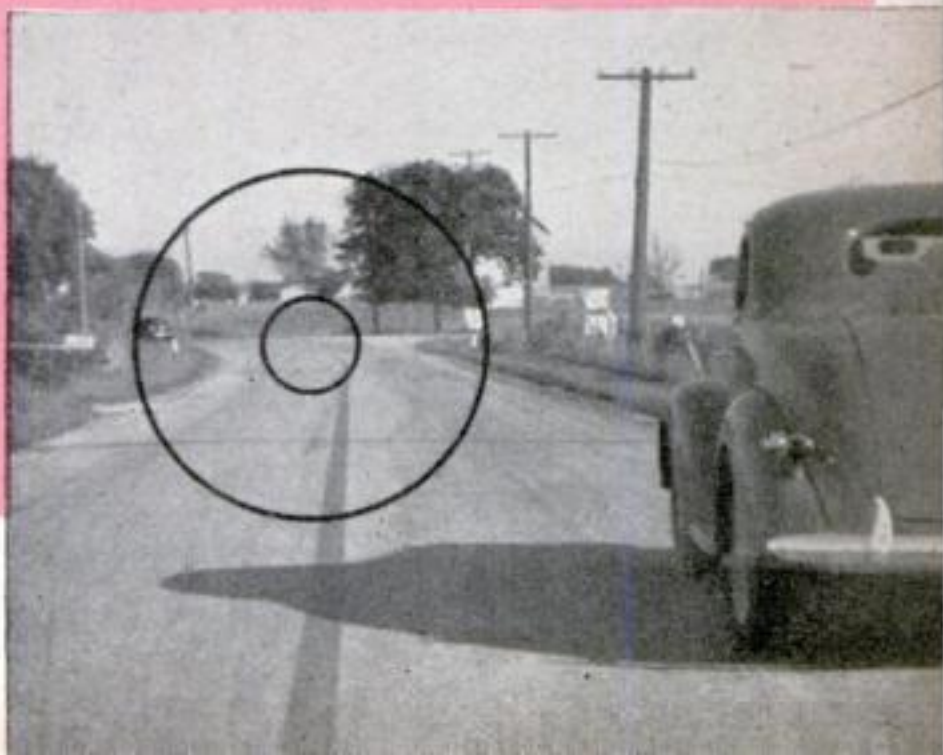
The "danger meter" is simply two concentric circles drawn upon celluloid and affixed to the windshield directly ahead of the driver with cellulose tape. As the driver travels along the highway, the scene ahead appears as shown in the illustrations. When he wants to pass the car ahead, a quick glance through the "danger meter" tells him if danger is too close to risk passing. If the edges of the road ahead at the farthest visible point lie outside the rim of the small circle, the driver is too close to a curve or a hill to take a chance on passing.

Likewise, even though the "danger meter" shows the road ahead at a point so far away that the edges of the road appear to lie well inside the small circle, there still may be



Passing on hills causes many collisions. Here the road, at the farthest point visible, overlaps the small circle of the "danger meter." You cannot see the road far enough ahead to make it safe to try passing the car in front

This time it's a curve. Again, the road seems wider than the small circle, at the farthest point you can see. Your windshield range finder is warning you to get back into line and stay there until you see what's around that curve

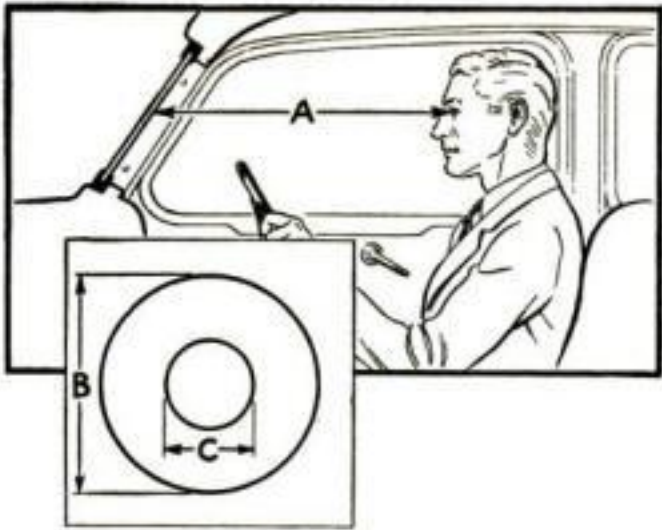




danger. If there are approaching cars between the driver and the farthest visible point, it is obvious that it is not safe to overtake the car ahead. Also, the road must be fully visible between the driver and the farthest point of the road in sight. If there is a sharp dip ahead, it may hide an approaching car.

The larger circle is designed to tell the driver when he is following another car too closely. If the car ahead, when sighted through the "danger meter," appears larger than the large circle, the driver is following too closely for safety if the car ahead should stop suddenly. When the driver stays far enough behind so that the car ahead appears completely within the large circle, there will be a safe stopping distance between the driver's car and the car ahead.

The "danger meter" is designed for quarter-mile visibility for passing and for an even 100-foot clearance in following another car. To make one for your car, take a two-inch square of clear celluloid. Have a friend measure the distance from your eyes to the windshield at a point directly in line with your eyes when you sit comfortably behind the wheel. This distance (Table "A") measured in inches will tell you, from Table "B," how large to make the large circle, while table "C" will tell you what size



DIMENSIONS FOR "DANGER METER"

A	B	C
16"	1"	$\frac{3}{8}$ "
17"	1"	$\frac{3}{8}$ "
18"	$1\frac{1}{8}$ "	$\frac{3}{8}$ "
19"	$1\frac{1}{8}$ "	$\frac{3}{8}$ "
20"	$1\frac{1}{4}$ "	$\frac{1}{2}$ "
21"	$1\frac{1}{4}$ "	$\frac{1}{2}$ "
22"	$1\frac{3}{8}$ "	$\frac{1}{2}$ "
23"	$1\frac{3}{8}$ "	$\frac{1}{2}$ "
24"	$1\frac{1}{2}$ "	$\frac{1}{2}$ "
25"	$1\frac{1}{2}$ "	$\frac{5}{8}$ "
26"	$1\frac{5}{8}$ "	$\frac{5}{8}$ "
27"	$1\frac{5}{8}$ "	$\frac{5}{8}$ "
28"	$1\frac{3}{4}$ "	$\frac{5}{8}$ "
29"	$1\frac{3}{4}$ "	$\frac{5}{8}$ "
30"	$1\frac{7}{8}$ "	$\frac{3}{4}$ "

to make the small circle. Both circles should be drawn using the same center, both should be made with black India ink. The inner circle tells whether you have a clear road for passing, the outer circle tells whether you are allowing a safe distance between you and the car ahead. The small variation for eye distance shows that the accuracy of the "danger meter" is not vitally affected by the driver's shifting forward and back in his seat.

Do not use the "danger meter" as a gun sight. Staring through it might cause you to fail to see dangers approaching from the side. Merely glance through it quickly to appraise your position. At other times it is so inconspicuous that it will in no way interfere with your vision. Being transparent, it does not violate state laws that prohibit stickers on the windshield.

Many head-on collisions occur at night or in fog. The device is as effective at such times as in ordinary daytime driving. Proper use of the "danger meter" will give you a sense of security when you drive. Two or three weeks' use of it will educate you into an accurate concept of distance judgment. Head-on collisions can be reduced when drivers know when and where it is dangerous to overtake and pass.



Many head-on collisions occur at night or in fog. The "danger meter" is fully effective at such times

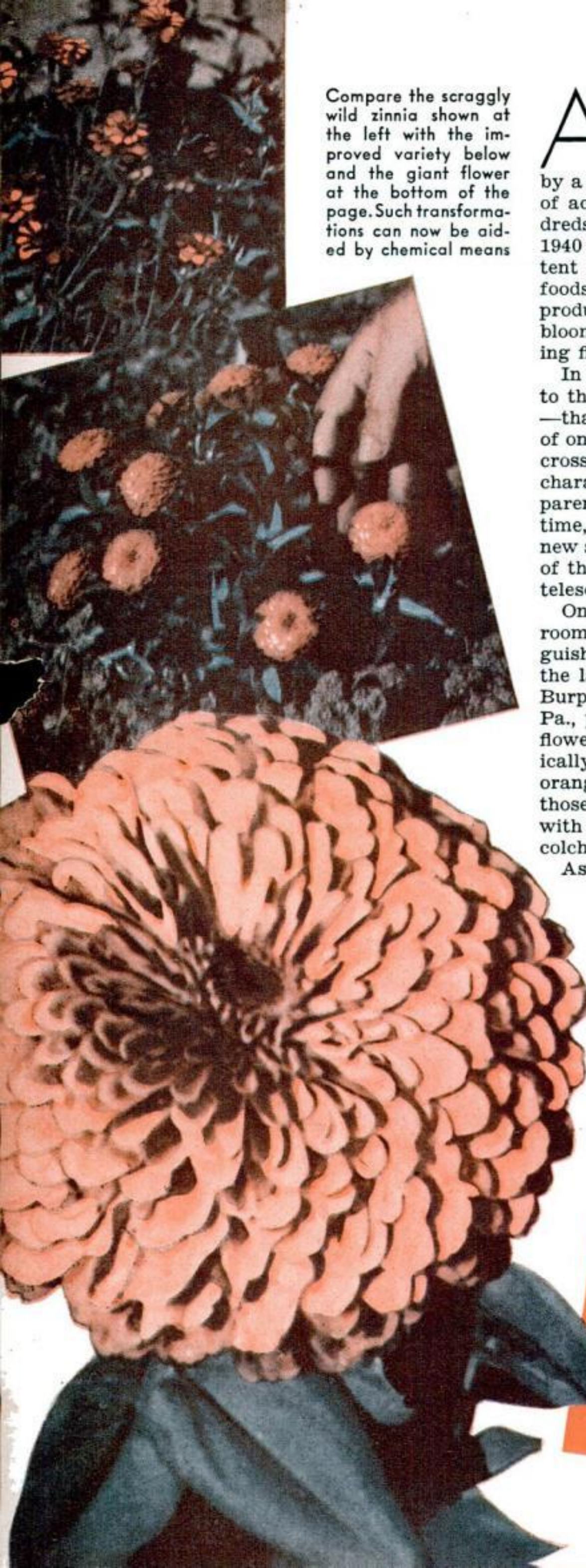




TEST-TUBE MAGIC  
CREATES  
*Amazing New Flowers*

By EDWIN TEALE





Compare the scraggly wild zinnia shown at the left with the improved variety below and the giant flower at the bottom of the page. Such transformations can now be aided by chemical means

**A**MONG the rainbow-hued pages of your seed catalogue, this spring, you are likely to find brilliant blooms and unusual plants created by a new kind of Luther Burbank. In place of acres of experimental gardens and hundreds of thousands of tiny seedlings, the 1940 plant wizard is using tiny vials of potent drugs, X rays, and amazing synthetic foods. With these laboratory aids, he is producing better farm crops, brighter blooms for your back yard, and longer-lasting flowers for your vases.

In former years, new plants were added to the lists largely by artificial fertilization—that is, by placing pollen from the flower of one species on the flower of another. The crossbred plant that developed often showed characteristics different from those of either parent. Many steps, and long periods of time, frequently were required to produce new species in this way. By the new methods of the laboratory, the work of years can be telescoped into the space of a single season.

Only a few days ago, in the grand ballroom of a New York City hotel, distinguished guests assembled to view one of the latest achievements of the kind. David Burpee, noted plant breeder of Philadelphia, Pa., presented in preview "Tetra," the first flower ever created for the market by chemically accelerated evolution. A brilliant orange marigold with petals suggesting those of a carnation, Tetra was developed with the aid of a yellowish drug called colchicine.

As sulfanilamide, a specific for many human ills, was the "miracle drug" of 1939, so colchicine





## PLANT WIZARDS USE X RAYS AND NEW WONDER DRUGS IN MAKING BLOSSOMS TO ORDER IN THE LABORATORY

(pronounced kol'-ki-sin), the producer of plant wonders, may rank as the miracle drug of 1940. More poisonous than strychnine, known since the days of the Aztecs, used for centuries in the treatment of gout, colchicine is obtained from seeds of the wild meadow saffron.

Its magic effect on the cells of plants—altering the character of the seeds, thickening the leaves, enlarging the pollen grains, changing the shape and color of the blooms—is being explored at the present time as the direct result of an accidental discovery made, nine years ago, in a Bulgarian greenhouse.

At that time, a scientist named Dontcho Kostoff was studying changes that took place from generation to generation in eggplant. One day, he found his glass-inclosed laboratory overrun by insect pests. To eliminate them, he sprayed the plants with nicotine sulphate. Later on, Kostoff was puzzled by the number of mutations, or freaks, that seeds of the treated plants produced. Experiments showed that the cause of these variations was the alkaloid poison in the insecticide.

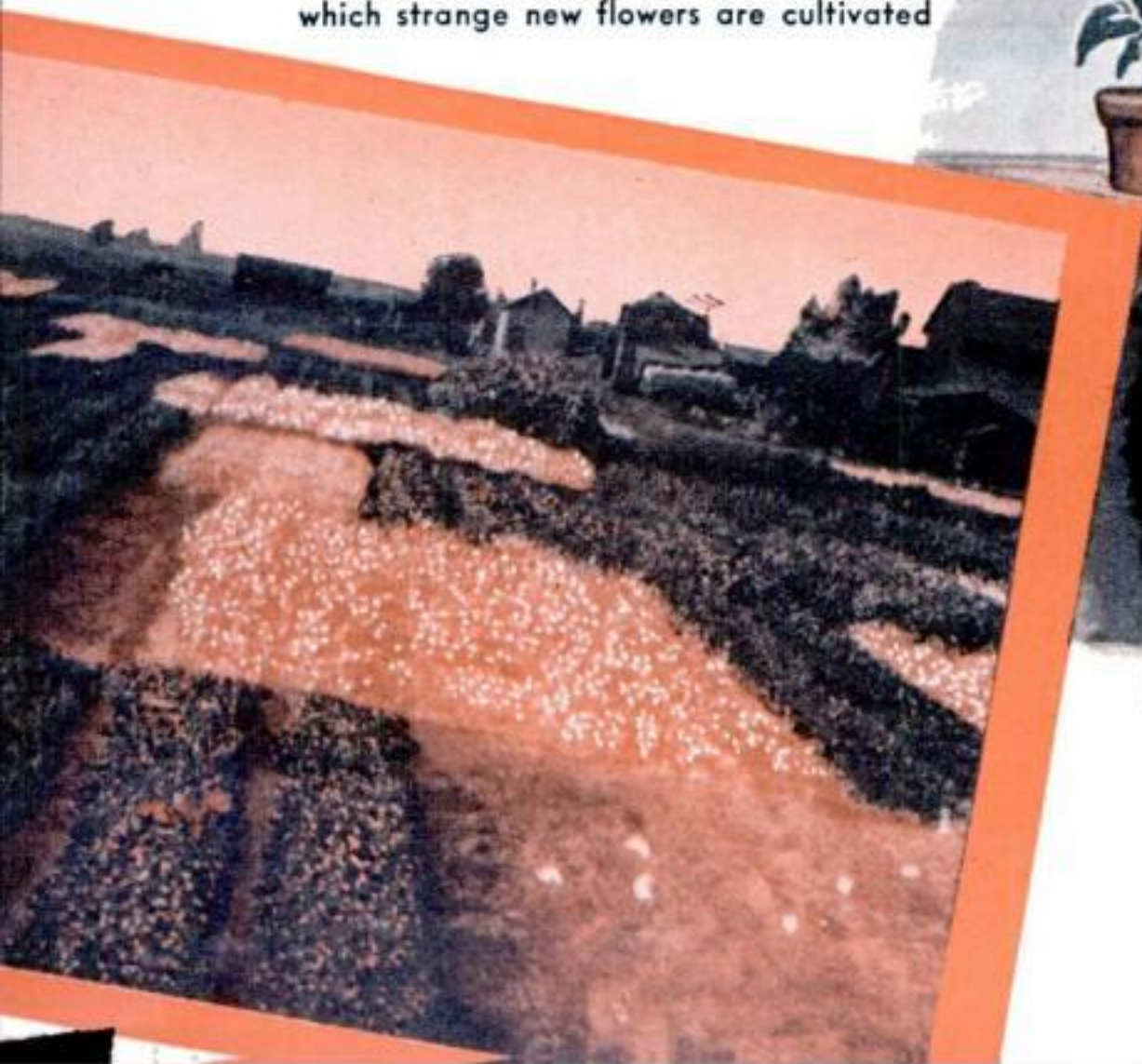
That discovery put science on a thrilling trail. The hunt for other and more effective alkaloids began. Three years ago, Dr. Albert F. Blakeslee, Carnegie Institution geneticist at Cold Spring Harbor, N. Y., and recently elected president of the American Association for the Advancement of Science,

used the poison drug of the Aztecs, colchicine, in experiments with Jimson weed. Results were spectacular. Other laboratories, in other parts of the country, took up the magic drug and workers began experimenting with fruits, grains, and flowers. The amazing results of their labors are now becoming apparent.

Already, "one-generation miracles" of the kind have given us raspberries capable of growing farther south than any previous variety; tobacco richer in nicotine for insecticides; cotton having increased resistance to disease and drought. Tetra, the new marigold, is said to stay fresh, when cut and brought indoors, far longer than any other species. Numerous other garden plants are now in the process of development.

At El Monte, Calif., Elizabeth Bodger, one of the leading women producers of new plants in the world, is using the latest drugs, as well as X rays and cross-fertilization, to create brilliant new blooms for your garden. Her latest achievement is an arresting "tiger-striped" zinnia. Another

Spraying a plant with colchicine, the new wonder drug. Below, a California field in which strange new flowers are cultivated







Flower-show exhibits like this will be enriched by new and better blooms created by plant wizards using new scientific methods



This exquisite white-and-magenta hibiscus is an odd product of cross-pollination





David Burpee, noted plant breeder, with specimens of the new "Tetra" marigold, a flower actually created by chemically accelerated evolution. It has orange petals shaped like those of a carnation



These three zinnias of different colors were grown on a single bush. Occurring as a freak among yellow zinnias, the unusual bush was made a stable variety by painstaking breeding





spectacular innovation of hers is a cosmos which has a double row of petals that give it the appearance of being two flowers in one.

A second research center on the West Coast is also adding new creations to those available for horticulturists. At the greenhouses of the Coolidge Rare Plant Gardens, Pasadena, Calif., scientists have produced a giant variety of hibiscus with strikingly marked petals of white and magenta. A recent announcement from the same laboratory reported success in grafting rare cactuses so they produce exquisite flowers years before their normal time of blooming.

Research workers at this and similar "gardens of the future" are plant explorers of a new kind. Instead of roaming the far corners of the world in a search for exotic species, they are creating, at home, flowers and plants never seen on earth before.

Hormone baths, (*Continued on page 227*)

One of the methods of applying colchicine solution to a plant. Leaves are immersed directly in the liquid contained in a vial



Millions of blooms are used annually to decorate floats for floral pageants. Plant magic will provide new colors



Gathering tulips for  
a local festival. A  
new American indus-  
try is tulip culture



Miss Elizabeth Bodger, a  
leading plant breeder, in  
her experimental gardens



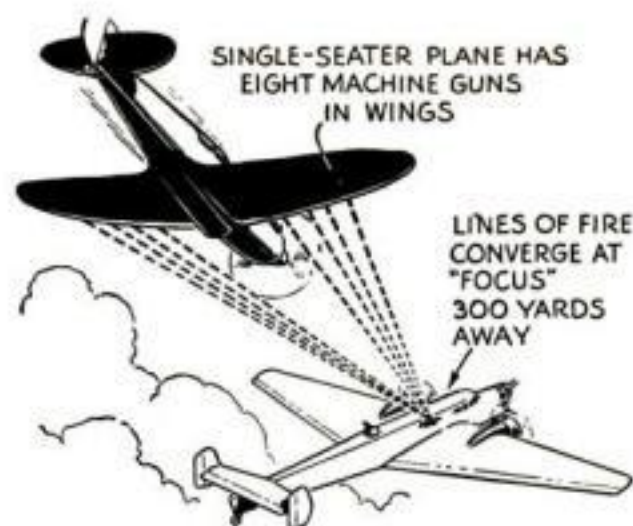




Three stages in the development of a new flower. Top, single bloom; right center, double bloom; bottom, fully rounded flower. Right, bombarding seeds with X rays to alter hereditary qualities







## Eight-Gun Planes Concentrate Fire on Single Spot

EIGHT separate machine guns mounted in the wings of the "Spitfire" fighting planes of the British Royal Air Force concentrate their simultaneous fire on a point 300 yards dead ahead of the planes. Thus, when an enemy plane is brought into range by means of a swift surprise attack from above, the converging fire of all eight guns rips into the hostile craft like a whirling buzz saw. Since each gun fires twenty times a second, the deadly spray of bullets from the eight guns reaches a rate of nearly 10,000 shots a minute. At right, above, ground attendants are "loading" a cartridge belt into a Spitfire's wing.



Shell-loading and gun-testing operations on the plane. Notice empty cartridges flying in lower pictures as eight guns fire at once

## Sails Help Trundle Produce to Market



Sails rigged on wheelbarrows of Chinese farmers make the going easier

NO POSSIBLE form of aid is overlooked by the ingenious Chinese peasants pictured in the photograph at the left, who have to trundle heavy loads of produce in crude wheelbarrows from their farms to markets in near-by towns. Whenever a breezy day comes along, therefore, each farmer rigs up a square sail, spreading it between upright poles fastened at the front of his barrow, to let the wind give him a lift on the trek to town to sell his wares.





## Put a Nickel in the Slot and It Feels Your Pulse

BLOOD pressure and pulse rate are measured by a novel coin-operated slot machine recently introduced. When a person drops a coin into the machine and straps his arm down as pictured above, the apparatus automatically tells him whether his pulse is fast, slow, or normal, and whether his blood pressure is high, average, or low.



## Special Glasses Aid Cataract Sufferers

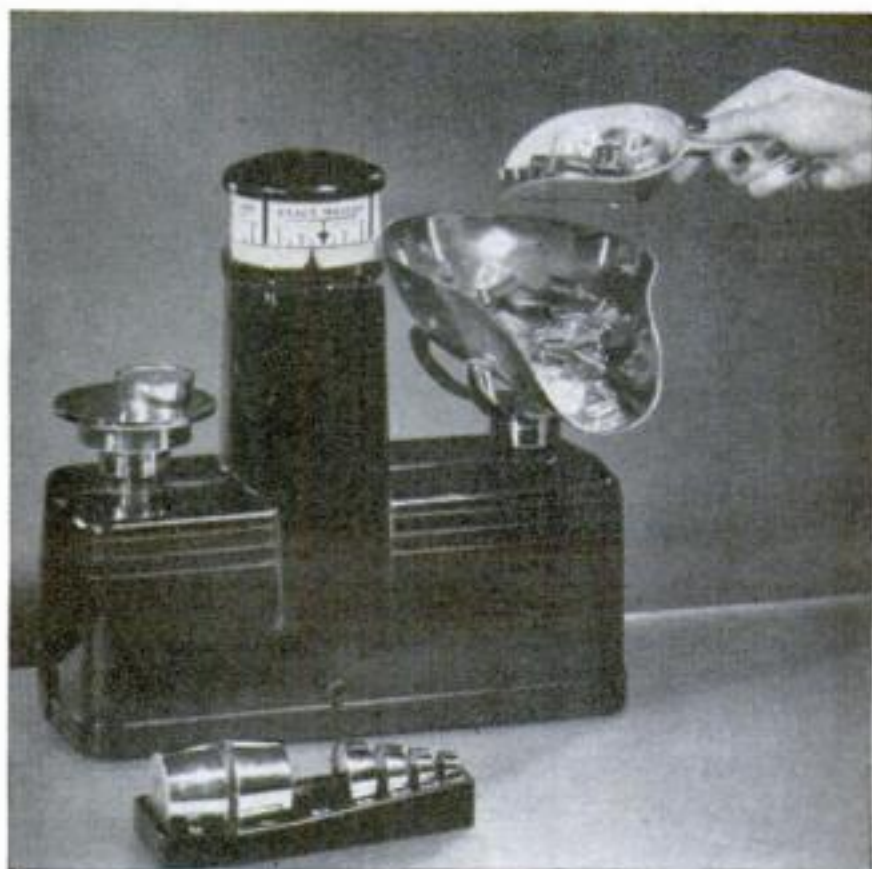
Opaque lenses cut off excess light, and the wearer sees through oblong slits

## Mountain-Top Windmills To Generate Power

GENERATING electricity by harnessing powerful winds that blow continuously on certain mountains in New England, is a possibility being studied by weather scientists of Harvard University, Cambridge, Mass. Wind records kept on Mt. Washington, N. H., and other peaks are said to indicate that wind power at such sites would be more reliable than water power.

## Odd Scales Weigh Candy

HOUSED in the top of a column resembling a miniature lighthouse, the dial of a new balance scales for weighing candy reveals whether the amount measured into the scoop on one balance weighs more or less than the metal weight on the other balance.



POOR vision experienced by persons suffering from cataract of the eye may be improved by special glasses developed by Drs. Ida and William Finebloom, of New York City. Cataract of the eye, it is explained, involves the appearance of small opaque spots on the normally transparent lens of the eye. These spots cause light rays entering the eye to spread in all directions, so that too much unconcentrated light falls on the retina, producing a blurred image. The new eyeglasses cut off excess light by incorporating lenses coated with opaque enamel except for a clear oblong strip. The inventors do not claim that the spectacles cure the condition, but merely improve the vision.





## Swim Suit Made of Glass

DRESSED in a glass bathing suit, the young lady at the left exhibits the latest use of an ultra-modern fabric, to a research scientist of the firm that developed it. Woven from spun glass, the cloth has been made into dresses, window curtains, and other products.

## Solder in Paste Form Is Easy To Apply

SOLDER in paste form, just placed on the market, dispenses with soldering iron and flux. Applied with a brush to the metal, which needs no preliminary cleaning, it makes a firm bond when heated.



The fabric of this bathing suit was woven from spun glass

## Electric Map Trains Air-Raid Wardens

BRITISH air-raid wardens now learn how to protect civilians with an illuminated map of typical streets and buildings. By pressing buttons, an instructor lights up different lamps, denoting the fall of high-explosive, incendiary, or poison-gas bombs. Prospective wardens take notes of what they would do, and make imaginary telephone calls for police, ambulances, or fire apparatus, for subsequent criticism by the instructor. An added touch of

realism is supplied by tiny models of policemen, cars, and a shot-down enemy plane, shown in the picture at lower left.

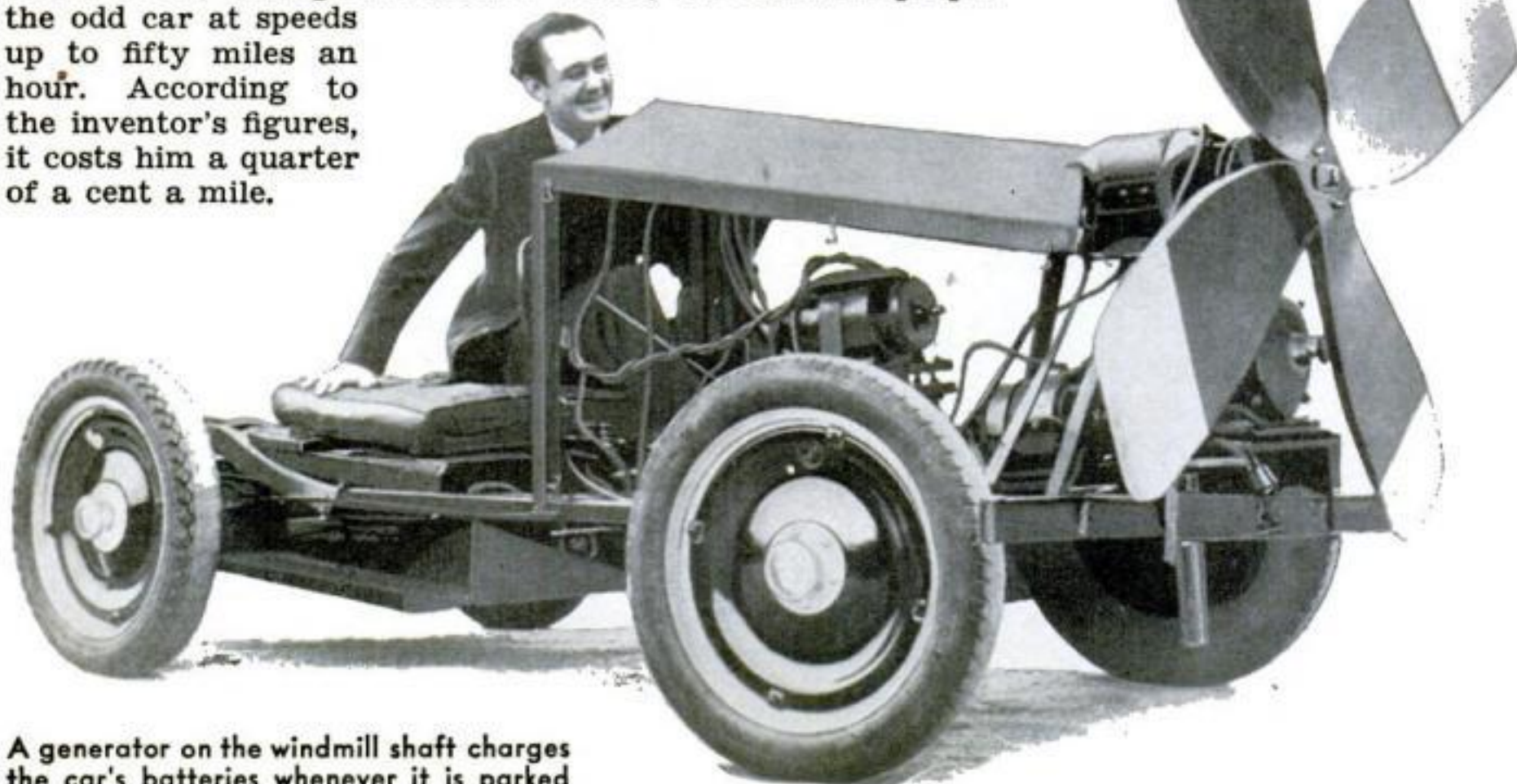


Problems in air-raid relief are represented by flashing lights and models like those at left



# Breezes Power Electric Car

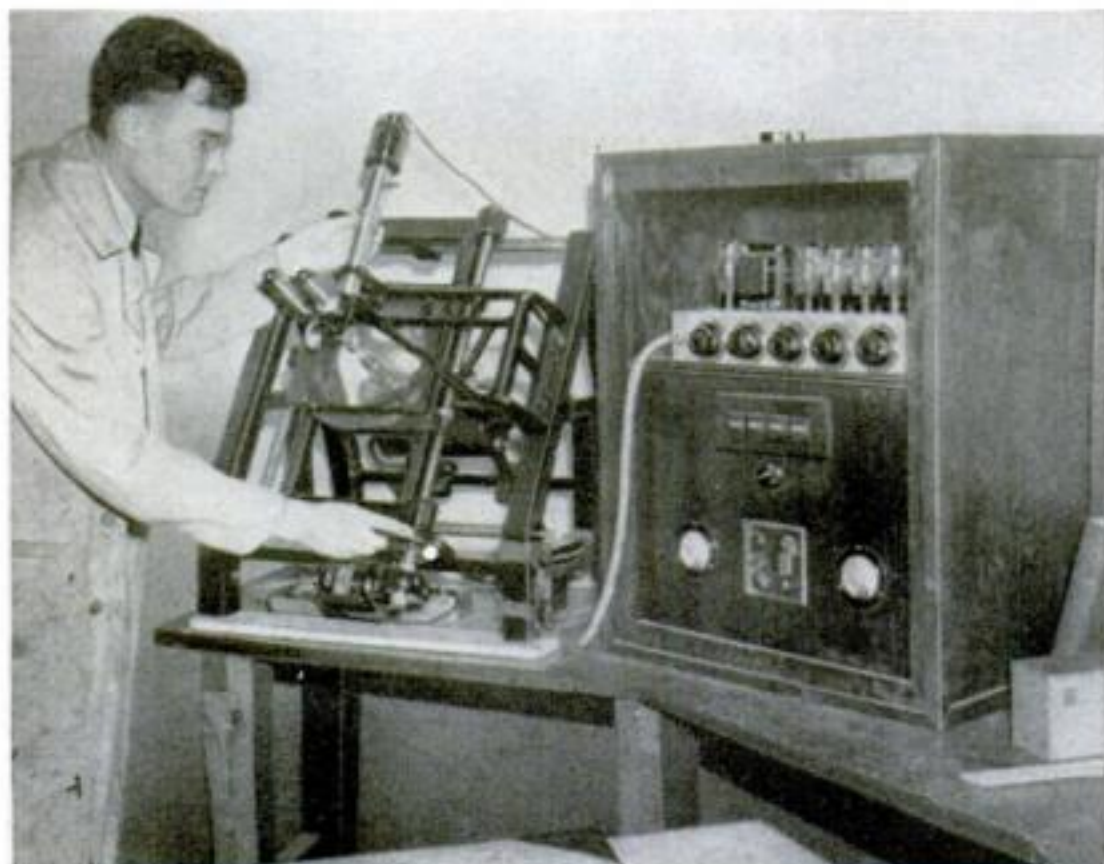
FREE air takes the place of gasoline to drive what J. C. Thomas, of St. Augustine, Fla., calls his "windmobile." While he parks, the breezes turn a windmill at the front, operating a generator that charges the machine's twelve storage batteries. Then, through an electric motor, the batteries propel the odd car at speeds up to fifty miles an hour. According to the inventor's figures, it costs him a quarter of a cent a mile.



A generator on the windmill shaft charges the car's batteries whenever it is parked

## Star Counter Aids Astronomers

AN ELECTRIC-EYE machine now speeds the task of counting the stars in the sky, so that astronomers may learn the structure of the universe. As a scanning beam traverses a photograph of a part of the heavens, the photoelectric counter automatically tallies stars of various magnitudes on separate dials. Small "sample" areas have previously been counted by eye.



This device counts stars appearing in a photograph of the sky



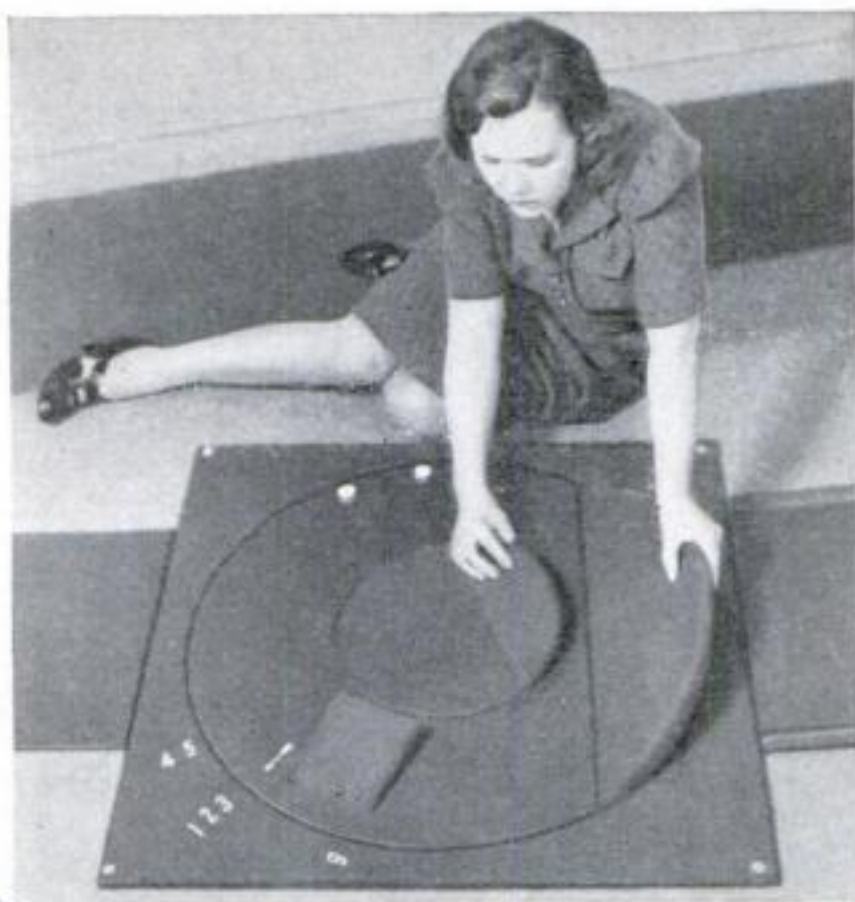
## Lamp, Magnifier Speed Manicures

A MANICURIST becomes a precision worker with the aid of the combination rack shown above. Like a jeweler, she observes her handiwork through a magnifying lens, under the rays of a lamp mounted on the same stand. Convenient trays for her tools and lotions are built into the kit.



# Indoor Golf Game Is Nine-Hole Course

INDOOR golf on felt greens that provide a "drag" similar to that of grass is possible with a novel game recently introduced. Covered with a heavy, deep-nap hair felt, disks and ramps form a playing surface requiring a space of only seven by three feet. A regular club and golf ball are used, and the various disks can be adjusted to present nine different approaches to the cup, each of which has a different scoring value for the players.



Making a difficult shot on the indoor golf green. Inset shows how "hazards" are varied to create different approaches to cup



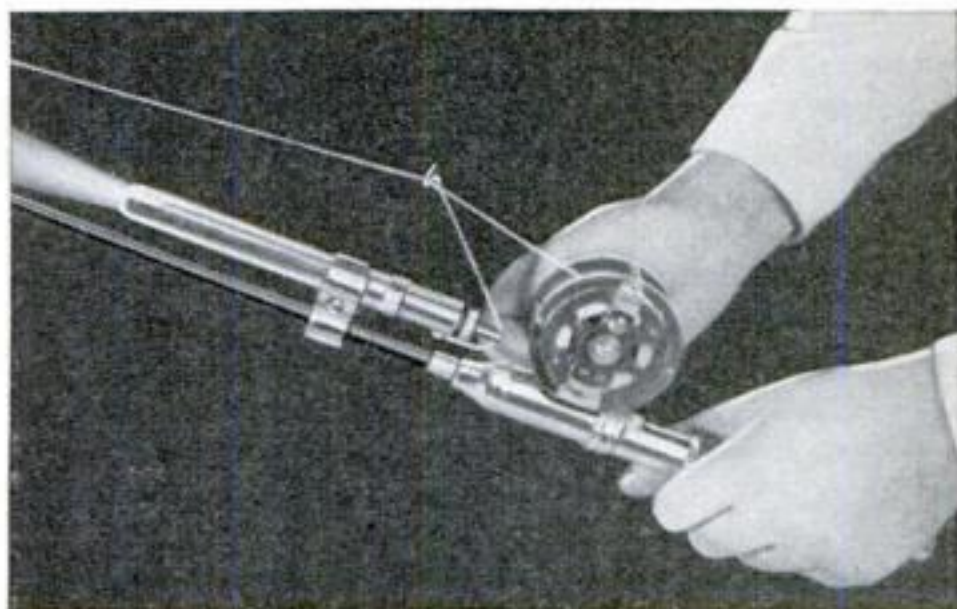
Hand power operates this lightweight drill

## Night-Fishing Light Clamps on the Rod

FOR night fishing, a fountain-pen flash light now on the market is designed to fasten onto a fishing rod. A wire loop holds the fishline above the light, which is clamped to the rod just in front of the reel, as seen at right.

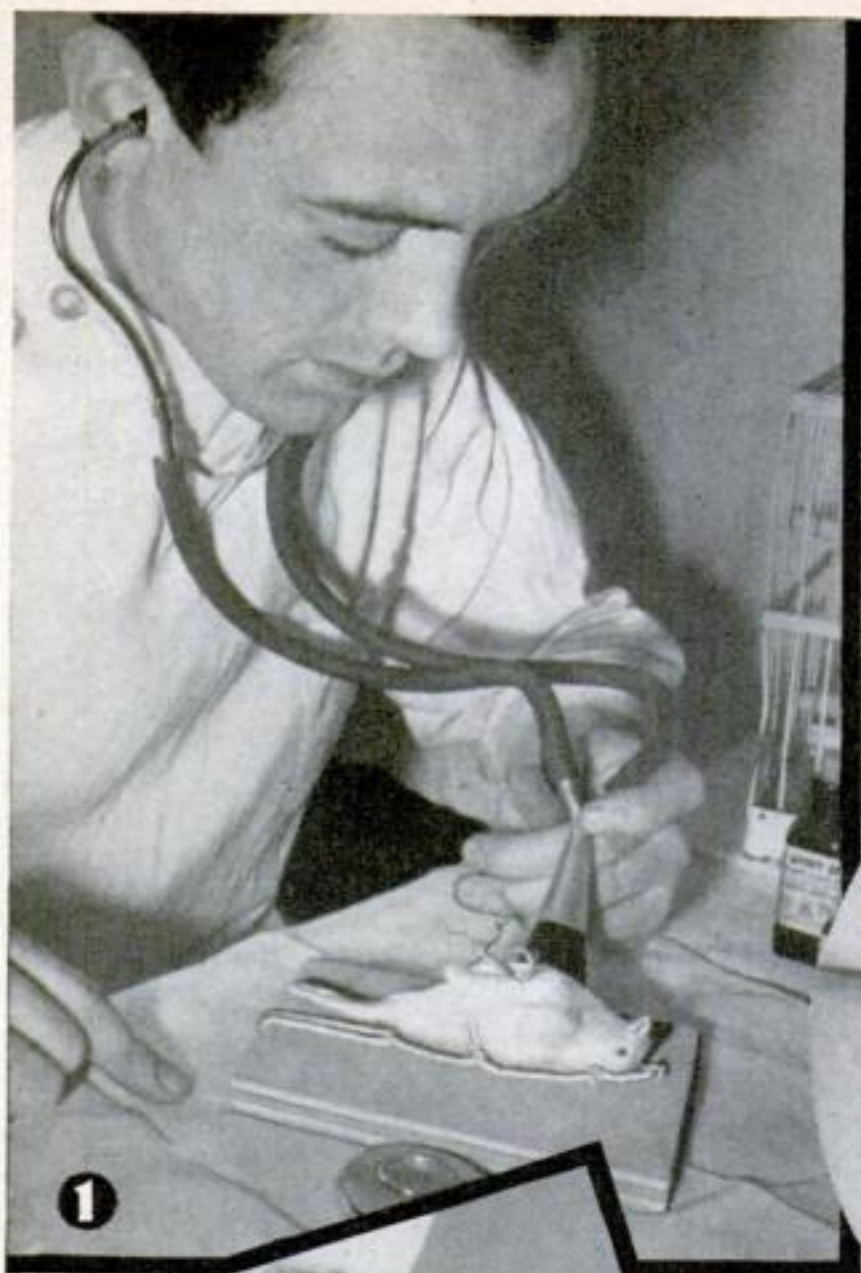
## Drill Driven by Hand Power Cuts Through Spring Steel

DESIGNED for use in locations where electric power is not available, the drill pictured at the left employs hand power. Weighing less than twenty-five pounds, the drill may be moved from the workbench to a job, thus saving time and labor. The special friction feed is said to make it possible to drill tough metals such as spring steel. A chain is provided with the tool for holding it securely and tightly against the work at any angle



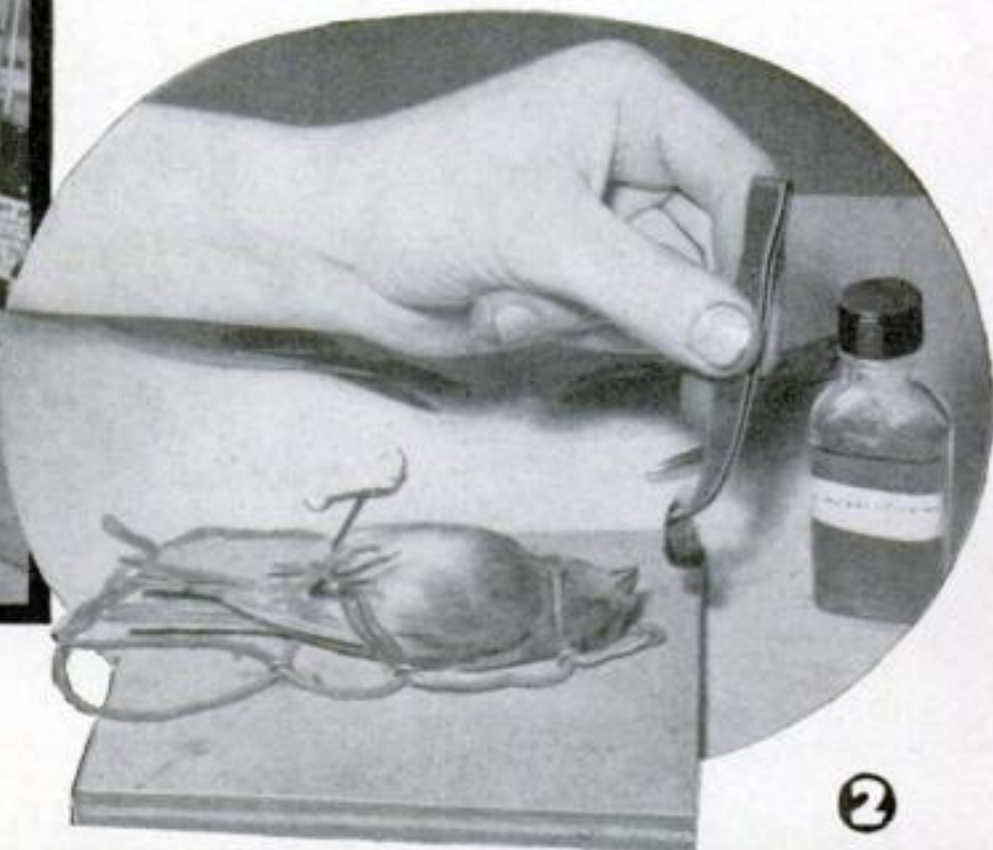
Flash light clamped to rod. Wire loop holds line clear



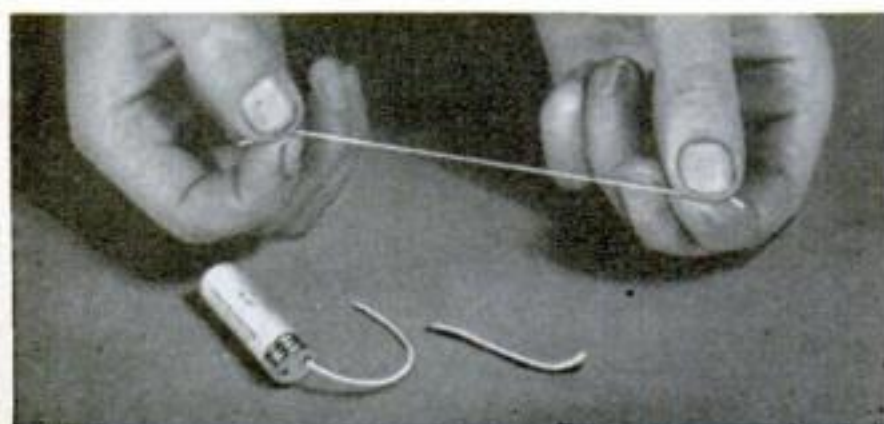
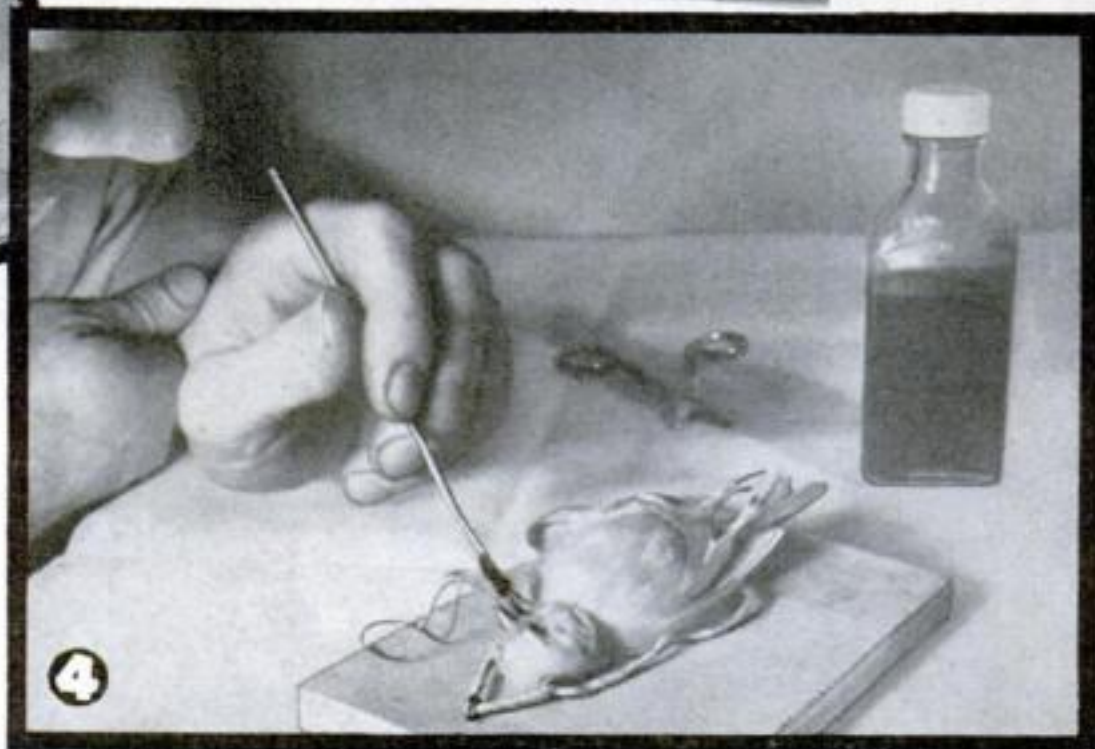


## He Runs a Hospital for Ailing Birds

OPERATING a hospital for birds is the unusual hobby of Patrick Lambert, of Jersey City, N. J. Set up in a room in his home, the hospital is fitted with homemade equipment that includes a plywood operating table four inches wide and six inches long, where ailing birds in need of surgical treatment are "strapped" down with light cord laced through small screw eyes. The photographs show the bird doctor at work.



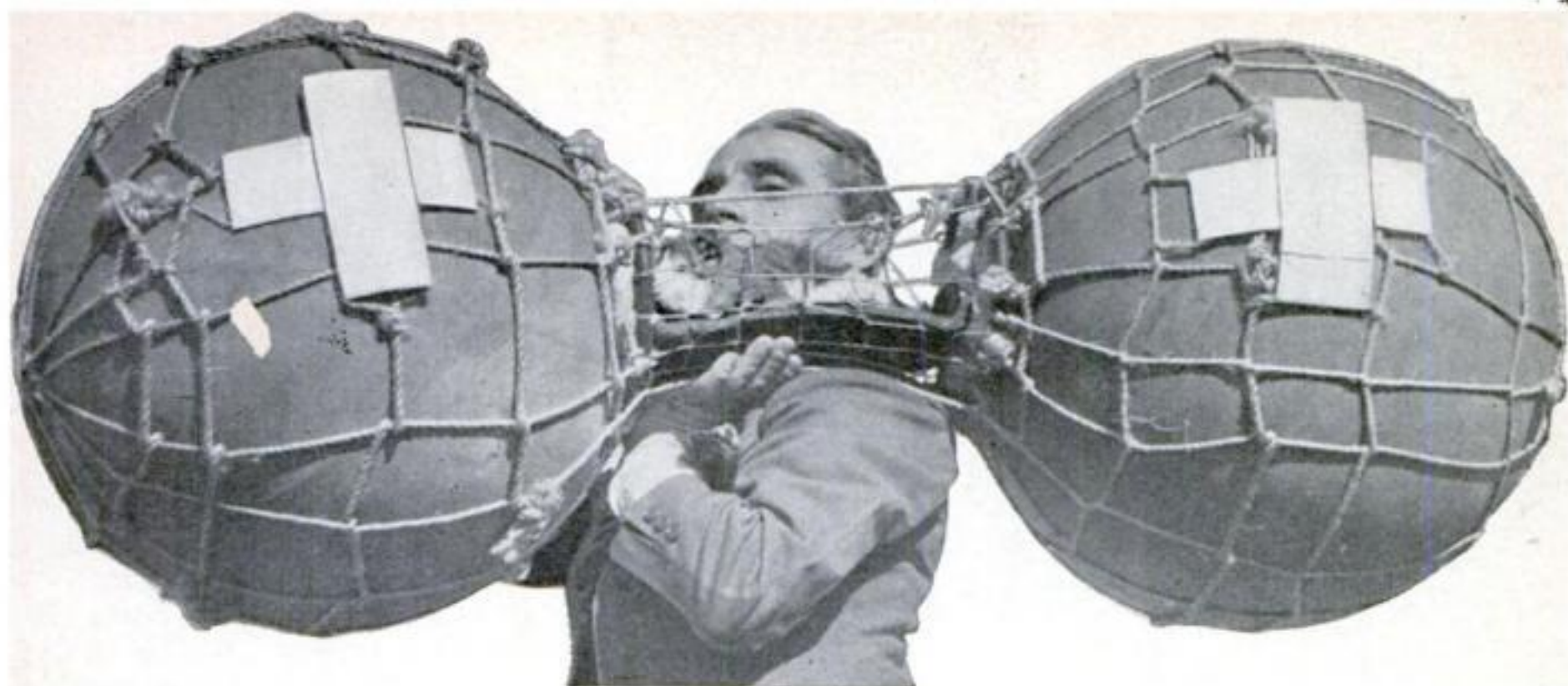
1, Patrick Lambert studies the heart-beat of a sick bird. 2, He administers chloroform to a patient on the midget operating table. 3, Breathing into a tube to prevent a pneumonia victim's lungs from collapsing. 4, Painting a songster's sore throat with argyrol



## Dental "Floss" of Rubber Fits into Tight Spaces

FOR cleaning teeth where the bristles of a toothbrush will not reach, dental floss made of rubber is now available. Because it may easily be stretched, the diameter of the floss can be changed to fit the spaces between the teeth to be cleaned.





## Guinea Pig Tests Novel Parachute

A SAFETY parachute minus trailing ropes and rip cords is the aim of Semen Kronhaus, of Los Angeles, Calif., shown above with a model of his invention. The strange-looking, dumbbell-shaped device, in which the pas-

senger rides in a basket slung between the two hollow rubber spheres which serve as shock absorbers, has been tested in numerous "jumps" from an airplane, with a guinea pig as passenger.



Cementing a torn nail back together with the new liquid



## Special Liquid Mends Broken Finger Nails

BROKEN finger nails now can be mended with a translucent liquid just placed on the market. The liquid is applied across the broken portion of the nail, which is covered with tissue paper before the liquid dries. When dry, the nail may be polished and even filed as it grows out.

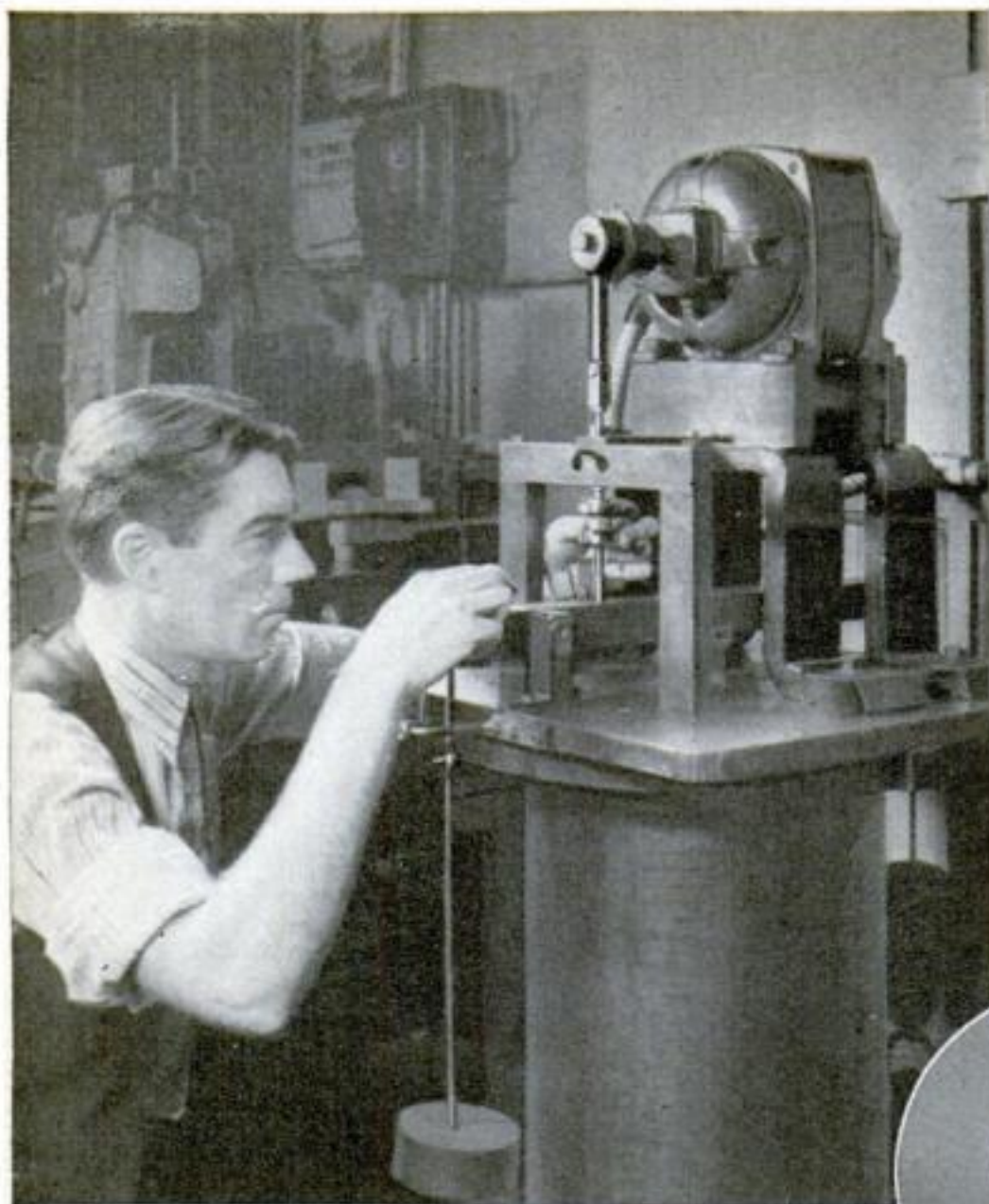
## Baggage Elevators Speed Unloading of Crack Train

STRUGGLING down the steps of a train with both hands full of bulky baggage is a thing of the past on a crack new Pacific Coast train. As the train approaches a station, porters in each car load the passengers' baggage into a small elevator reached from within the car. As soon as the train stops, the baggage is removed through a door that opens from the outside of the coach, as shown at the right.



As passengers get off the train, their bags are lifted from the elevator

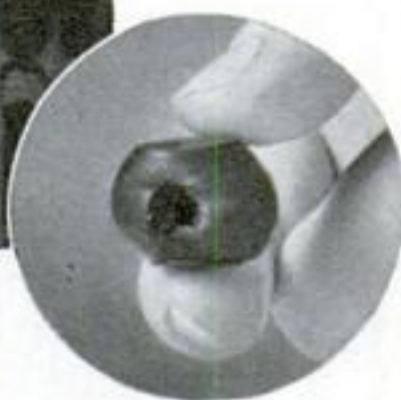




Placing a small button of sample rubber, like the one at the right, in the machine to test its resistance to heat generated by high-speed vibrations

## Vibrating Machine Tests Tire Rubber

A MACHINE that duplicates with small buttons of rubber the punishment an automobile tire takes in actual service is now being used by engineers of a leading American rubber company. The average passenger-car tire, the scientists state, receives 750 jarring highway impacts a minute when traveling at the rate of sixty miles an hour, and each impact sets up from 7,500 to 15,000 vibrations a minute within the tire. All this creates heat—rubber's worst enemy. By means of weights and vibrators, the testing machine subjects a small sample of tire rubber to twice the normal number of road impacts. By



comparing the machine's effects on more than 10,000 rubber samples during the last year, the engineers have been able to select those which, in a tire, will run cooler and offer the greatest resistance to heat.

## Novel Wrecking Car Gives Autos a Lift

SYLVESTER LOCKWOOD, a Norwalk, Conn., garage owner, believes in doing things thoroughly when he is called on to haul an automobile to his garage for repairs. That is his reason for the novel tow truck pictured below, which is fitted with hoisting equipment so that it can lift a car entirely off the ground and carry it

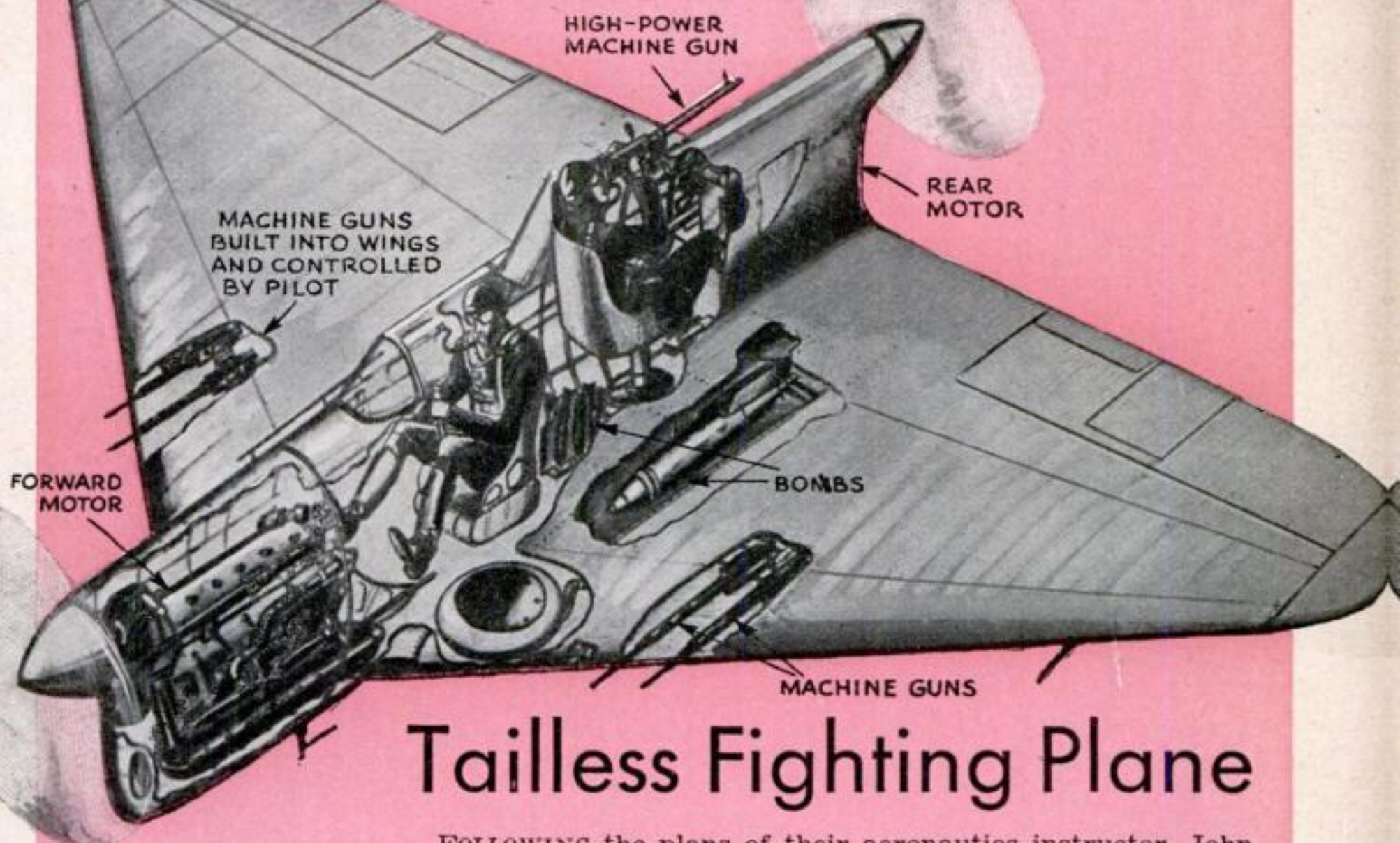
suspended in mid-air back to the garage. He has used this towing system successfully with vehicles ranging from light roadsters to trucks tipping the scales at 7,000 pounds.



Anything from a small car to a 7,000-pound truck is easily lifted off the ground and carried by this wrecking car

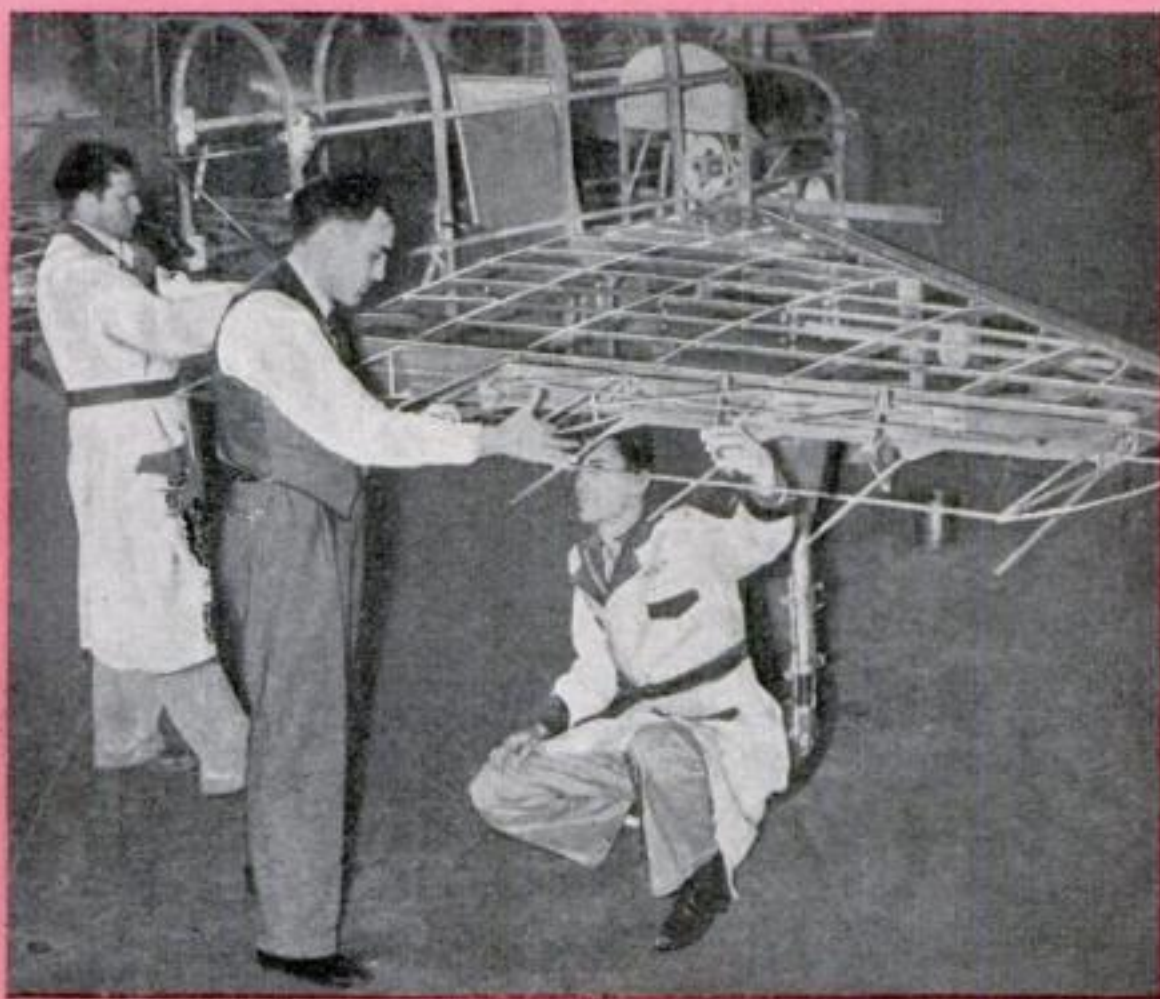


How the flying wing would be outfitted with machine guns and demolition bombs



## Tailless Fighting Plane

FOLLOWING the plans of their aeronautics instructor, John D. McKellar, nearly 150 students of the California State Polytechnic School are building a new kind of tailless airplane. The radical McKellar design calls for a "flying wing" with the fuselage inside, and propellers at both front and rear, making the strange machine a combination tractor-and-pusher type. His system of controls includes double flaps that open like the leaves of a door hinge. These flaps are pivoted horizontally near the trailing edge of the wing. When completed, the lightweight craft is expected to weigh less than 1,500 pounds. If it flies successfully, the same design may be used for a ten-ton military plane carrying bombs and a machine-gun turret. A cut-away sketch of the proposed military plane is reproduced above.



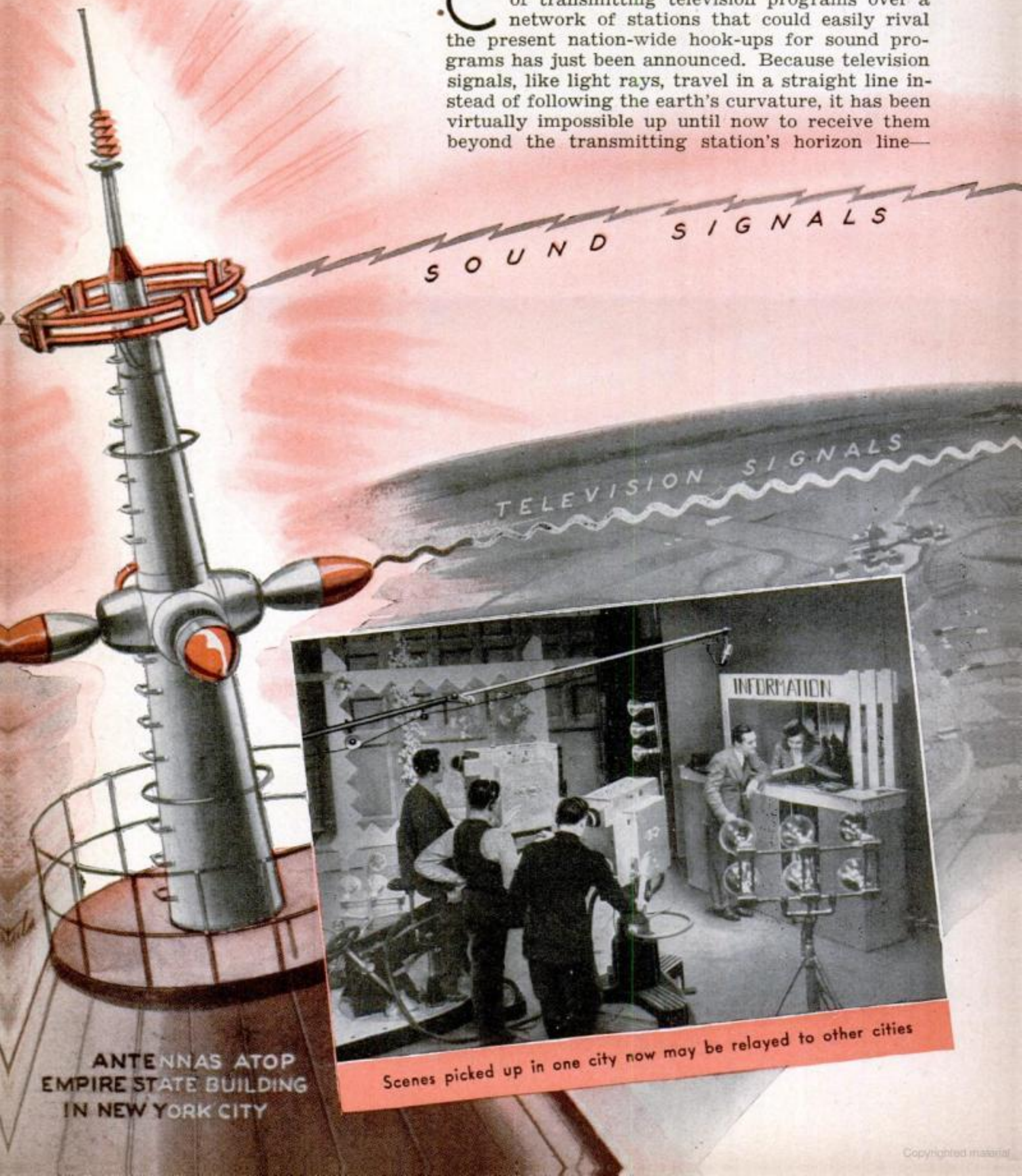
John D. McKellar (coatless) checks on his double-flap wing control



# Long-Distance Television

MADE POSSIBLE BY NOVEL RELAY SYSTEM

COMPLETELY successful in tests, a method of transmitting television programs over a network of stations that could easily rival the present nation-wide hook-ups for sound programs has just been announced. Because television signals, like light rays, travel in a straight line instead of following the earth's curvature, it has been virtually impossible up until now to receive them beyond the transmitting station's horizon line—



ANTENNAS ATOP  
EMPIRE STATE BUILDING  
IN NEW YORK CITY

Scenes picked up in one city now may be relayed to other cities

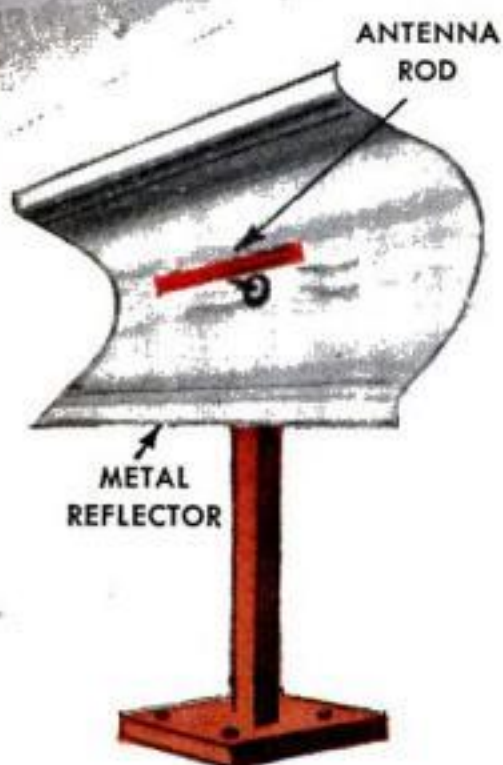




**TELEVISION SIGNALS ARE  
RELAYED FROM ONE AUTOMATIC  
STATION TO THE NEXT**



From tower to tower, signals "step" cross-country to a distant rebroadcasting station which delivers them to your home set



roughly, in a radius of about fifty miles in all directions.

Confronted with this serious limitation, research engineers set to work to expand the range of television. After many experiments with telephone lines and "coaxial" cables, Radio Corporation of America engineers devised the scheme of setting up point-to-point relay stations so that television programs might be boosted along through the ether from one automatic station to the next and fed into distant rebroadcasting stations.

In the accompanying drawing, the system is graphically illustrated. At the far left, television signals emanating from the skyscraper-top antenna of a metropolitan telecasting station are represented. Some thirty miles away, the signals are picked up by the antenna of the first automatic relay station housed inside a tanklike tower. Amplified 1,000,000 times, they are then shot with bulletlike accuracy by a special "parabolic" antenna, shown at left, to the next station farther on.





The chronometer swings outward for winding

## Globe Contains Instruments To Tell Time and Weather

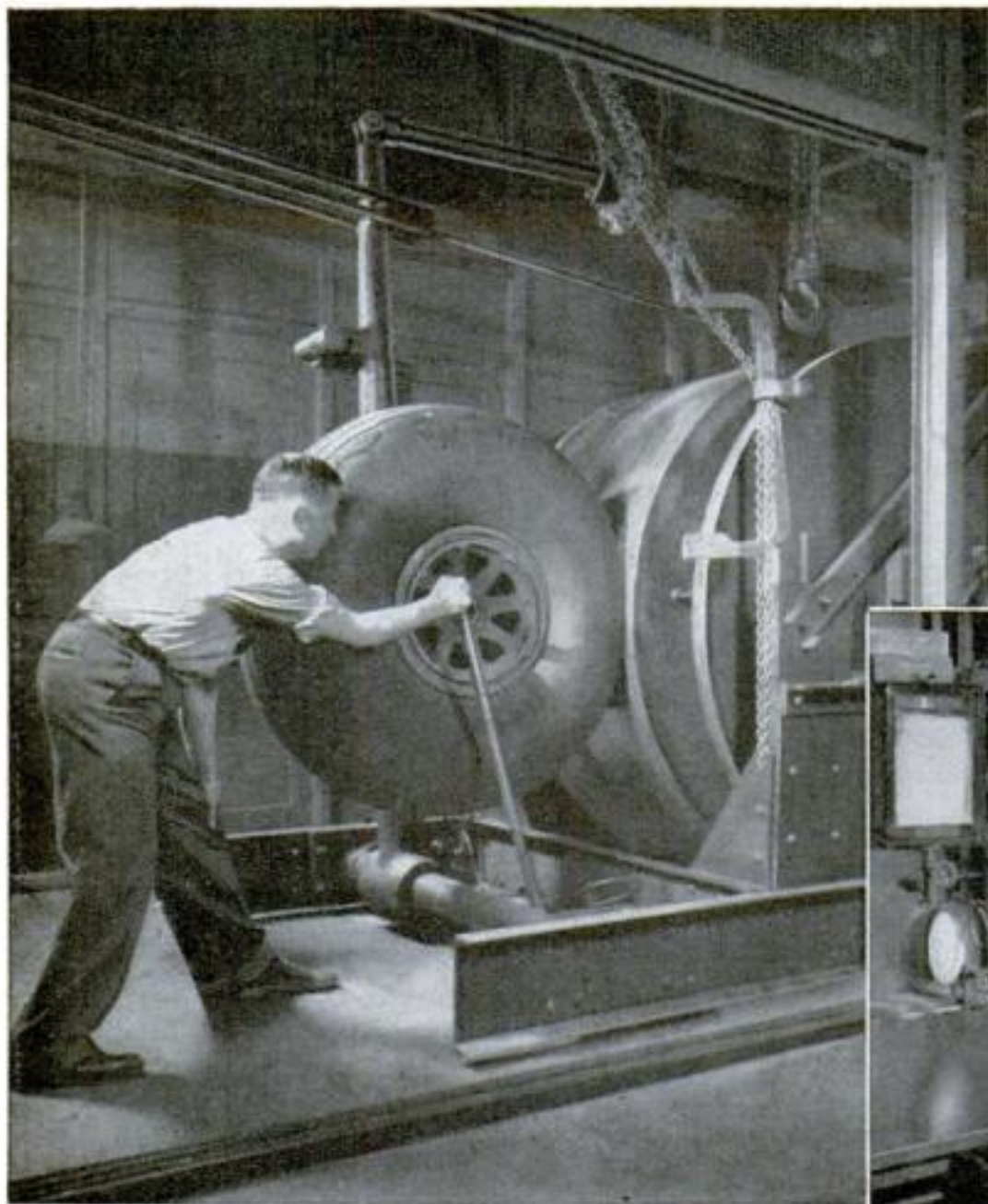
THERMOMETER, hygrometer, barometer, and chronometer are contained in an ornamental bronze globe recently placed on the market. A compass is set into the base of the outfit, while the chronometer timepiece is placed on a swivel so that it may be turned partly out for winding.

## Lever in Handle Opens Knife

PULLING one end of the handle opens the blade of the knife shown at right. It is impossible to break a finger nail attempting to open the blade, the makers state, since it is not necessary to touch the blade at any time. To close the knife, the handle end is pressed.

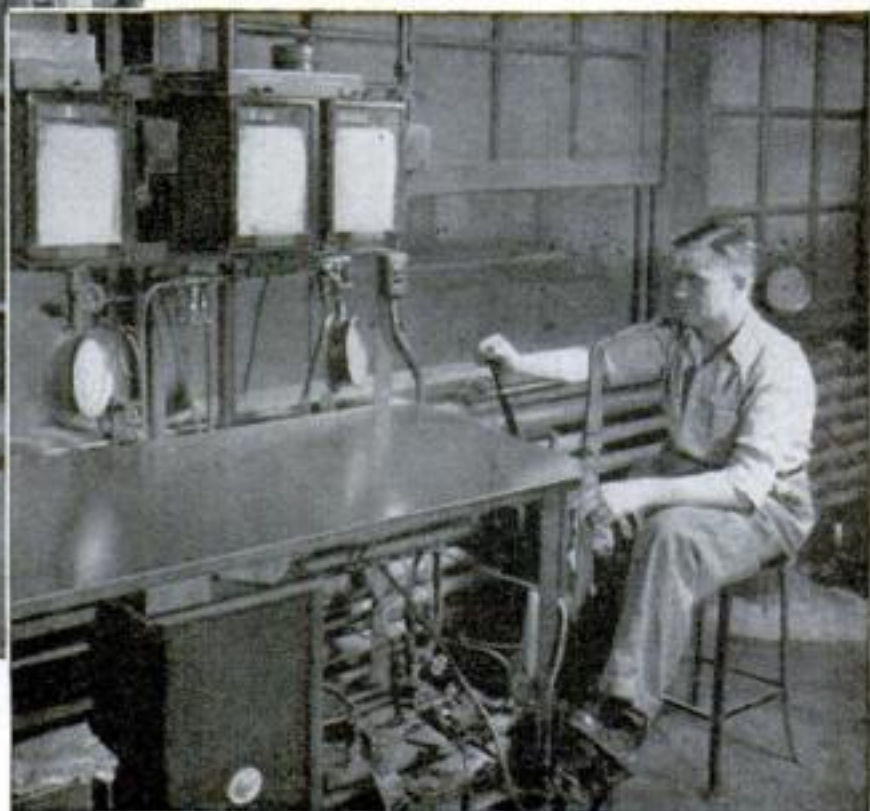


## Airplane Tires Are Given Third Degree



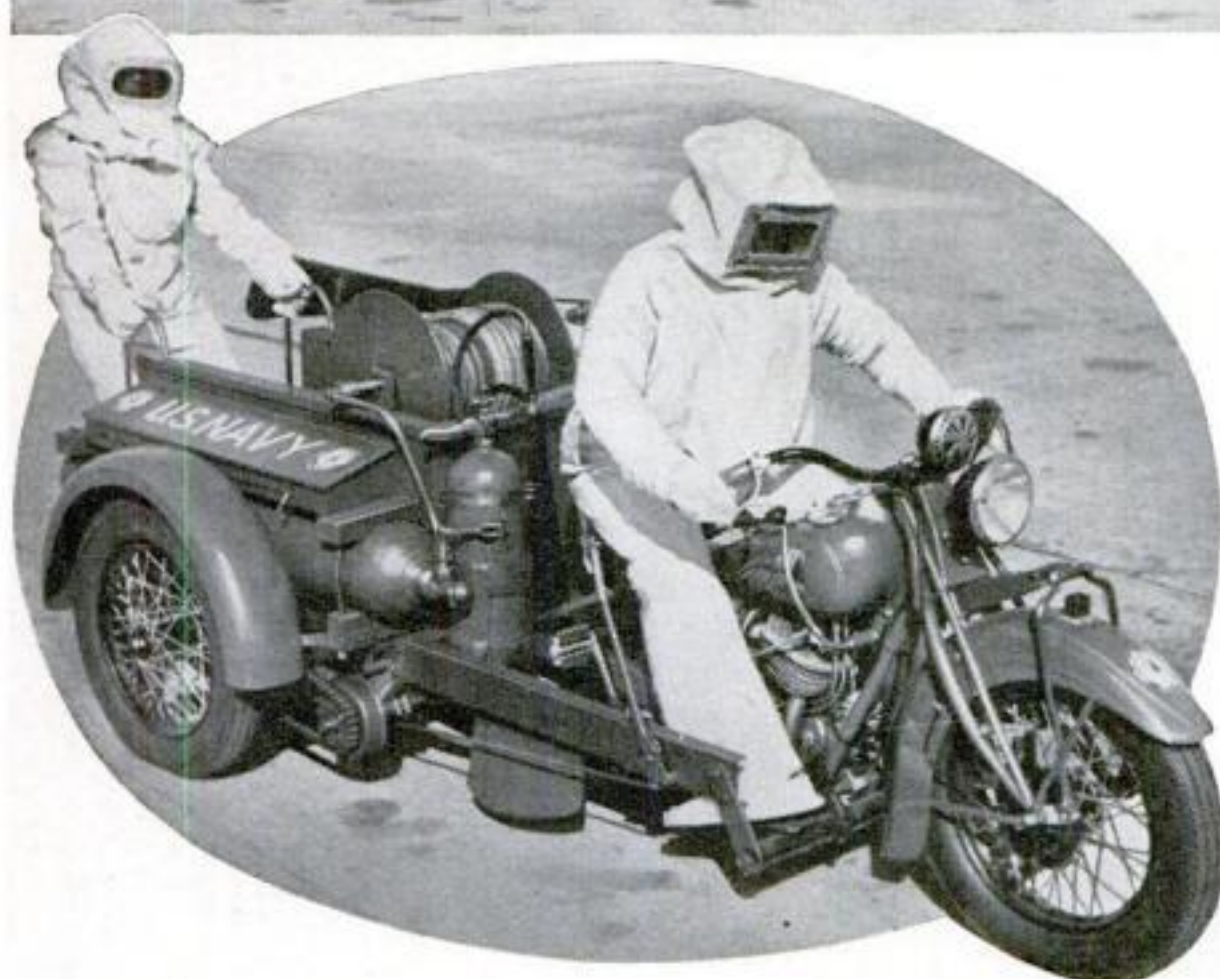
Bumping an airplane tire against a rapidly revolving drum simulates landing conditions. The instrument board at right records stresses

FORCING an airplane tire against a metal drum that is whirling at a speed of seventy miles an hour is one of the grueling tests given these tires to check their resistance to the impacts and strains encountered in actual service. The instrument board where factors of speed, drag, impact, and other conditions of the tire test are automatically registered, is pictured in the photograph below. After the tests, the tires are dissected to determine possible damage.





# Airport Fire Fighters Ride Motor Cycle



**M**ANNED by an asbestos-clad pair nicknamed "Snow Whites," a speedy motor-cycle fire truck has just been placed in service at the U. S. Naval Reserve Air Base at Floyd Bennett Field, New York City. If a plane crashes in flames, the odd machine will dash across the field to rescue the pilot and extinguish the blaze. Wielding a fifty-foot hose with a hornlike nozzle, as shown in the upper picture, the crew will spray the fire with carbon dioxide "snow" from a set of four tanks mounted on the strange three-wheeled vehicle.

Airport fire-rescue truck and crew. At top, stretching extinguisher hose

## Gloves Turn into Mittens When Flying Is Cold

GLOVES that can be turned into mittens, in flying through the cold upper air, are displayed at right by a British aviatrix. For extra warmth, sealskin cuffs fold down over the suede fingers, and a tug on a slide fastener completes the transformation. At the left of the illustration is the glove; at the right, the mitten.

## Movies of Ocean Depths

MOTION PICTURES of ocean depths as far as three miles below the surface are being made in the North Atlantic from the oceanographic research ship *Atlantis*. The camera is lowered into the sea in a water-tight housing fitted with a powerful light and a special window for the lens.



It's a glove. On the other hand, it's a mitten





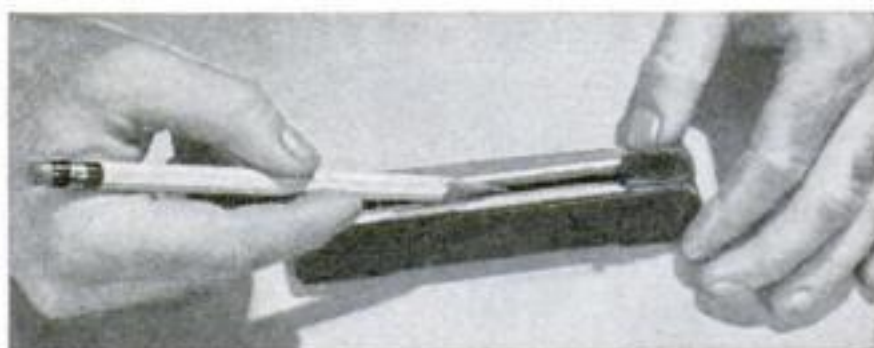
Electrodes inserted under the skin pick up tiny electric currents

## Electric Device Gauges Nerves

ARE you nervous, or relaxed? An electric "nerve meter" devised by Dr. Edmund Jacobsen, Chicago physiologist, tells the story. Fine platinum electrodes, painlessly inserted under the skin, pick up tiny electric currents in nerves and muscles. A resulting graph shows the degree of tenseness of the subject. Other tests with the device have detected unconscious lip movements of subjects when they were silently reading.

## Puts Points on Pencils

DRAWING a pencil through a V-shaped slot, in a new sharpener, quickly gives a keen point. Dust drops between two metal-backed surfaces of abrasive cloth into the base, which is easily emptied at will.



J. Steinlauf on his bedstead bicycle. Note the many accessories that it carries

## Bed Furnishes Frame For Bicycle

PERCHED atop one of the world's goofiest bicycles, J. Steinlauf of Chicago exhibits proudly his homemade encumbrance to traffic. A man of originality, he has tolerated no conventional parts except a horn, handlebars, and wheels. Part of a discarded bed forms the frame. Accessories include an alarm clock, a pair of household brushes, a comb, a hot-water bag, a bunk, and a horseshoe, since one can never tell when such oddments might come in handy.



## Versatile Alarm Clock Even Gets Breakfast

NO RAUCOUS alarm awakens David Olsson, Swiss amateur watchmaker, in the morning. Instead, a clock of his own construction turns on the light in his bedroom and starts a phonograph playing soft music. A few minutes before waking its owner, the versatile timepiece has lighted the gas stove, and when Olsson rolls out of bed he finds a potful of steaming coffee ready and waiting for him.



Painting the inside of a tubular plane-engine mount. Air pressure forces paint through tiny holes in tube



## Plane Tubing Painted Both Inside and Out

PAINTED both inside and out, tubular mounts for the motors of American Airlines passengers planes now receive double protection against corrosion. Forced in through small holes in the ring-shaped tubing, as shown above, the spray of paint reaches every part of the interior.

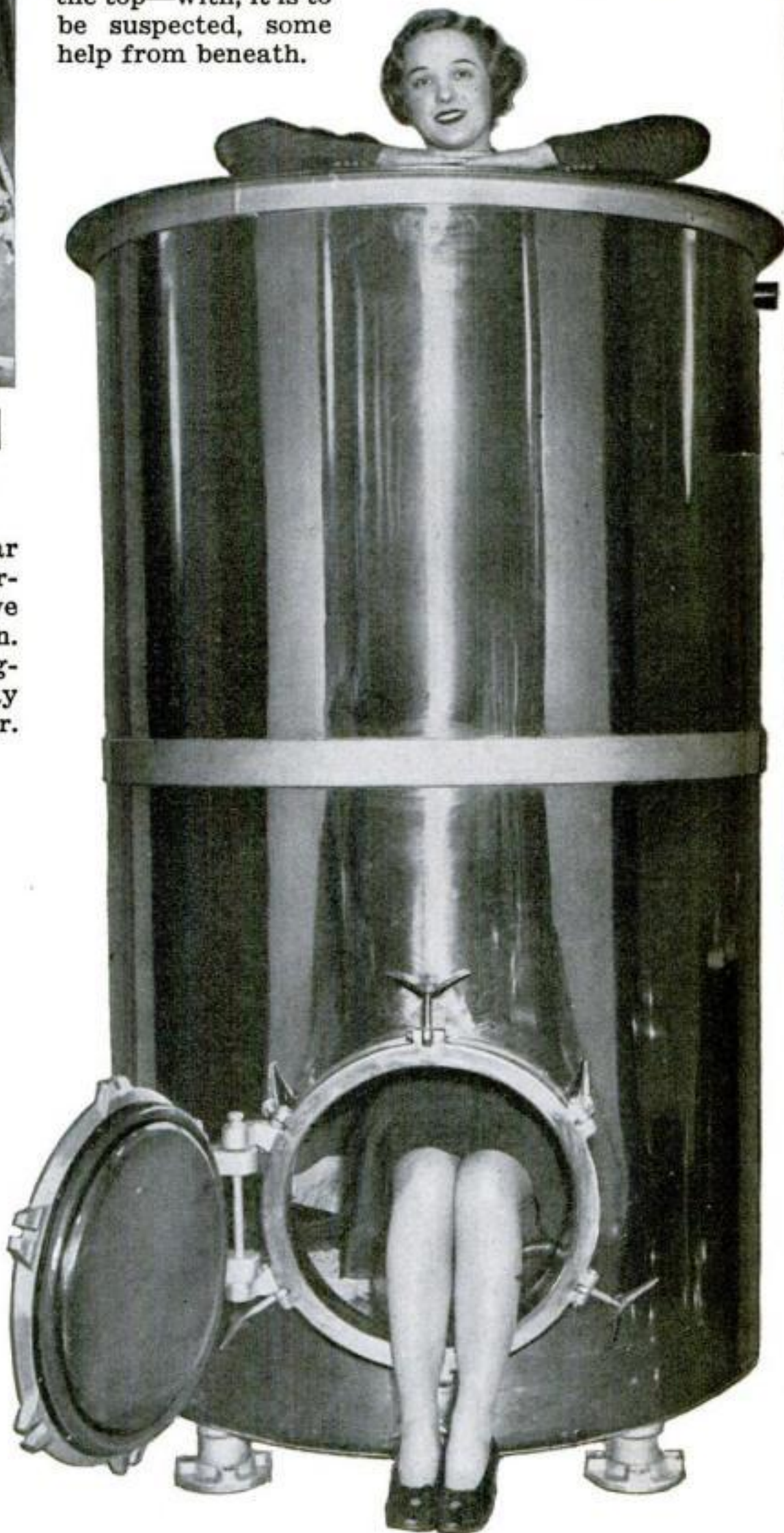


## Pooch Made Portable by Novel "Dog Bag"

DRESSED for traveling in the handy bag shown above, a small dog is readily carried by a pair of cloth grips. A slide fastener closes the top of the bag, and the front may be shut or left open as desired.

## Percolator Holds 600 Gals. —or Just Two, as Below

FROM head to foot is a long way in the monster percolators used in the canning industry. Made of stainless steel, the one illustrated below holds 600 gallons. During a recent convention of canners at Chicago, Ill., its size was graphically illustrated by the girl peering from the top—with, it is to be suspected, some help from beneath.







## Safe in Cashier's Chair Foils Holdup Attempts

A "BANDITPROOF" chair for cashiers has made its appearance, to foil holdups in stores and restaurants. Instead of handing over the money, the cashier unobtrusively slips it into a heavy steel deposit box beneath her seat, as shown in the illustration above. Once there, it is safe, since even the cashier cannot open the triple-lock receptacle by herself. Confronted with an empty cash drawer, the thug will make a hasty departure for better hunting grounds.

## Lightweight Sun Lamp Is Easily Carried



WHOLLY self-contained, a compact sun lamp of new design may easily be carried from room to room, or taken along on travels. Its S-shaped mercury-vapor tube emits healthful ultra-violet rays when the cord is plugged into a standard alternating-current outlet, providing current at sixty cycles and 110-115 volts. When the lamp is not in use, a lid protects the tubing from breakage. A compartment at the side affords space for the rolled-up electric cord, and for dark-tinted goggles to protect the eyes during use.



Resembling a portable radio, the sun lamp is used as above

## Radio for Police Car Receives Facsimiles



Photographs and fingerprints appear on a roll of paper in the set

FACSIMILE receivers, mounted on the instrument panels of patrol cars, now aid the Bergen County, N. J., police in tracking down criminals. Photographs and fingerprints of "wanted" suspects, transmitted from headquarters, appear upon a roll of paper in the mobile set. It may be operated either by radio or over telephone and telegraph lines. Complete secrecy may be obtained by pre-setting the new instrument to decode "scrambled" signals, which would be a meaningless jumble to any other receiver intercepting them.

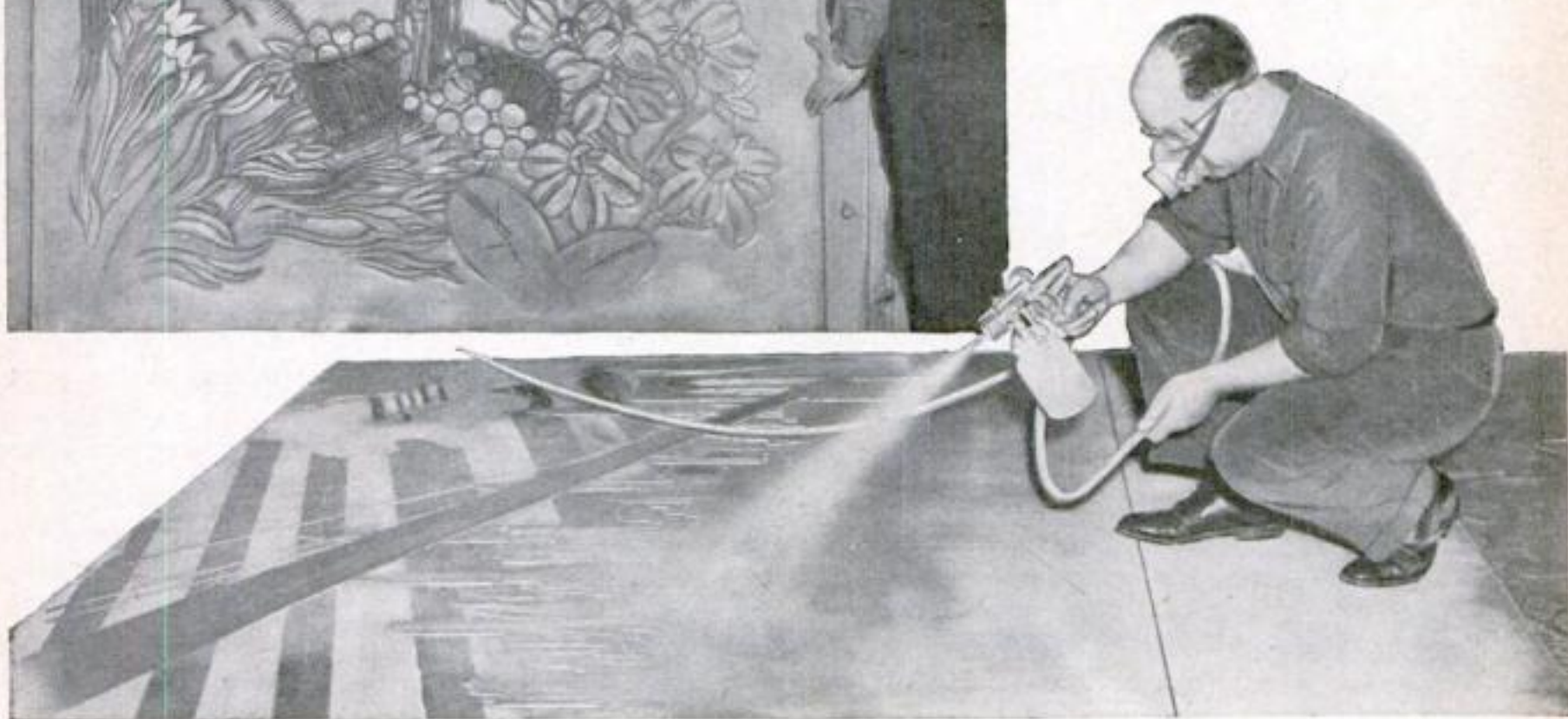


# Decorative Murals Carved in Linoleum

HANDSOME murals of carved linoleum mark an innovation in interior decorating. Sitting on the broad panel, the artist outlines figures and scenery by skillful cuts with his gouges and knives, until the entire design has taken form. During much of this time, a heat lamp on a portable stand is focused on the section he is cutting, to make the linoleum more pliable. His next step is to apply the coloring. Finally, after the surface has been rubbed over, he sprays it with a special clear lacquer that assures the permanence of his work. Ingredients of this lacquer are so chosen that it will expand or contract with heat or cold at the same rate as the linoleum, avoiding danger that the mural might crack with rapid changes of temperature after it is installed.



Sitting on a panel of linoleum, the artist outlines the design for a mural. After coloring, it is sprayed with a special protective lacquer, as seen below. At the left is a finished mural



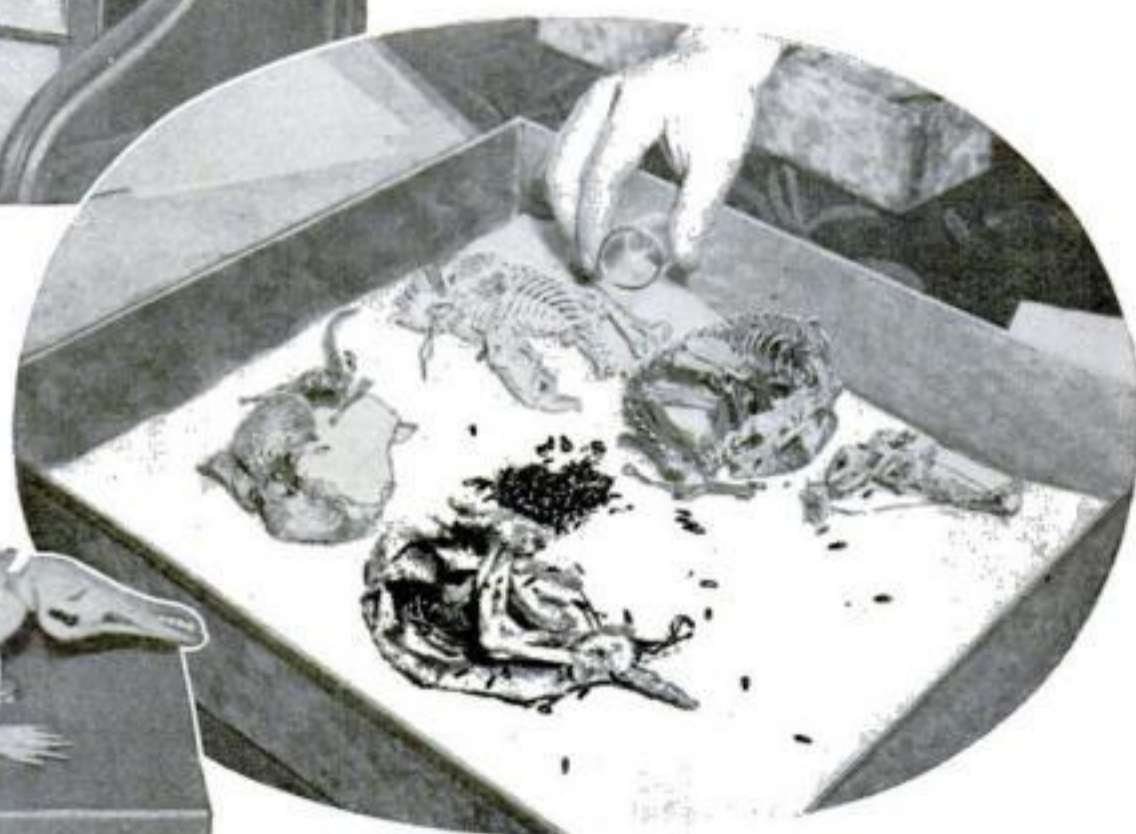


## Beetles Clean Up Bones for Museum

AN ARMY of 5,000 voracious beetles helps prepare exhibits for the American Museum of Natural History, New York City. Since the dried flesh that adheres to fragile and intricate animal skeletons would be extremely difficult to remove by hand, the specimens are placed in a tray with the insects, whose microscopic jaws soon pick the bones clean. Imported from Asia and Africa, the pampered beetles live and breed at a constant temperature of eighty degrees in a special metal-lined incubator.



In this metal-lined incubator the American Museum of Natural History keeps its bone-picking beetle army. The beetles are seen at work at the right. Below is a mounted skeleton



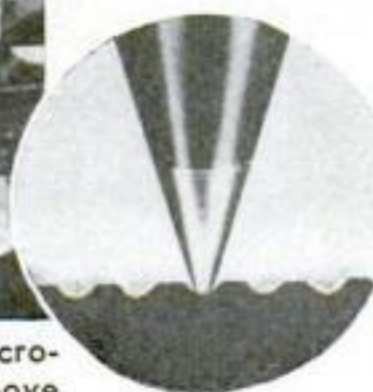
## Phonograph Needle Plays 1,000 Records

DECLARED capable of playing more than 1,000 records without tone distortion, a new long-wearing phonograph needle has just been placed on the market by a leading maker. Welded to its shank, a ball-pointed tip consists of a fine-grained alloy of rare metals related to platinum. Each needle receives constant inspection under powerful

microscopes during its manufacture, to insure that the shape and radius of the tip will make a perfect fit in the groove of the phonograph record, neither overriding nor wobbling about in it. The special alloy reduces friction to a minimum.

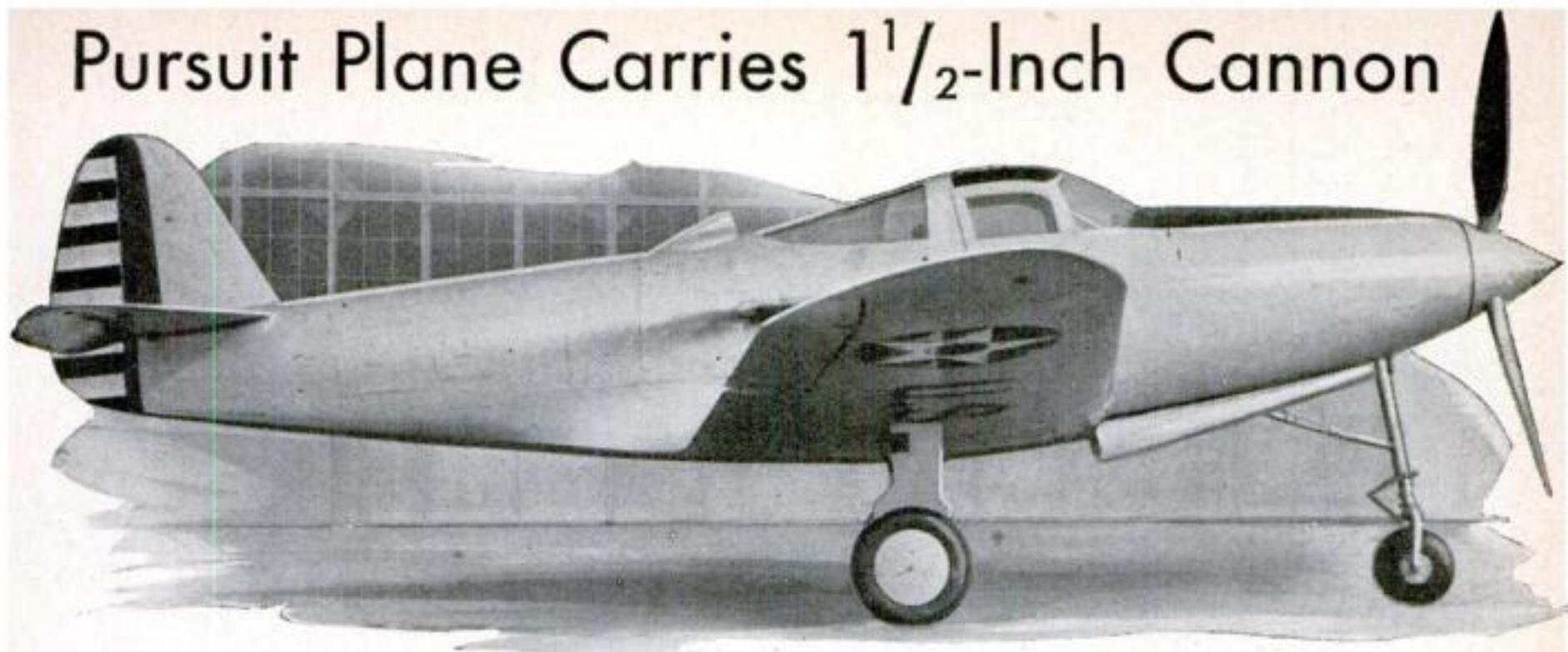


Inspecting needles with microscopes. The photomicrograph at right shows how alloy tip fits disk groove





## Pursuit Plane Carries 1½-Inch Cannon



**W**ITH a 1½-inch cannon firing through the propeller hub, four synchronized machine guns, and 400-mile-an-hour speed the new Bell "Airacobra" ranks as the foremost pursuit plane in the world. Now in

quantity production for the U. S. Army, the sensational craft can bring down a raiding bomber with one shell. Placing the cockpit near the center of the single-seater minimizes strain on the pilot in fast maneuvering.

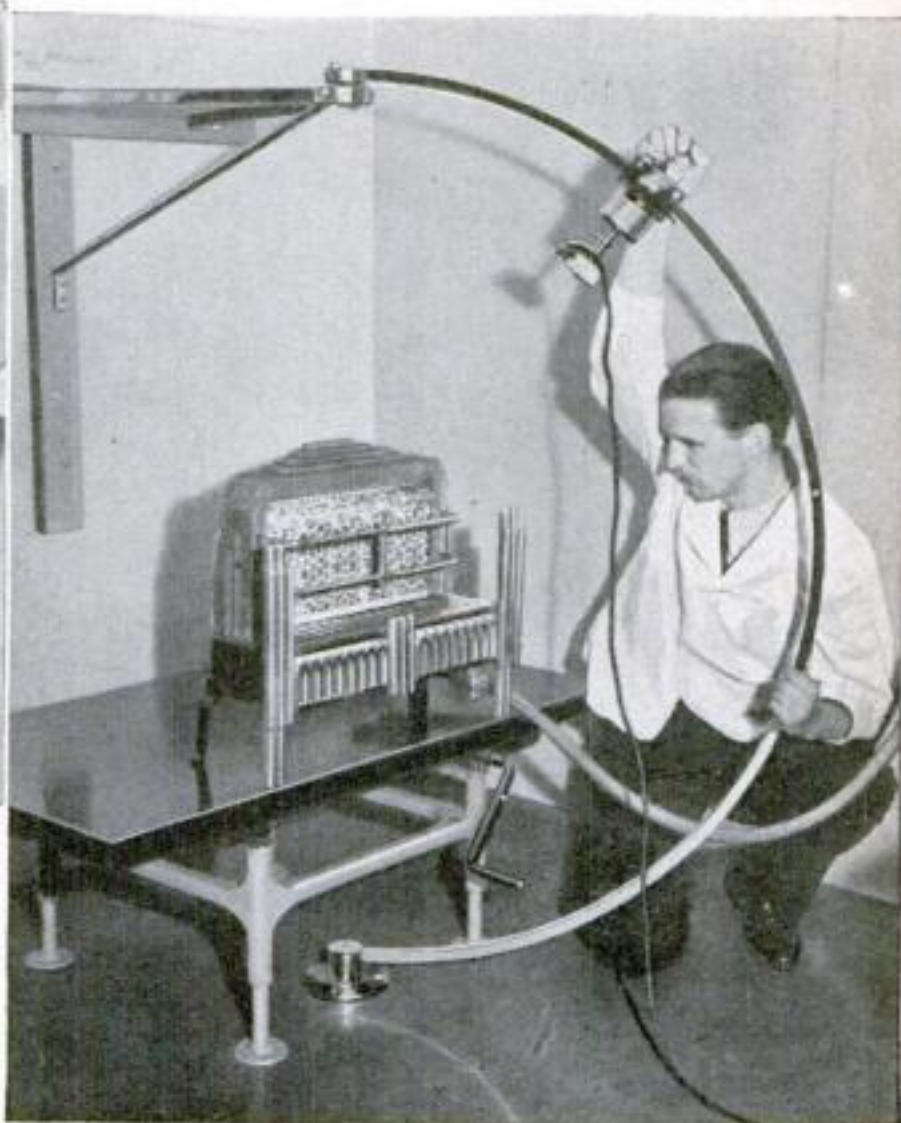
## Gas Appliances Tested for Efficiency

TO ASSURE the efficiency and safety of gas household appliances, before a manufacturer offers them to the public, the American Gas Association performs novel tests in a Los Angeles, Calif., laboratory. "Artificial steaks"

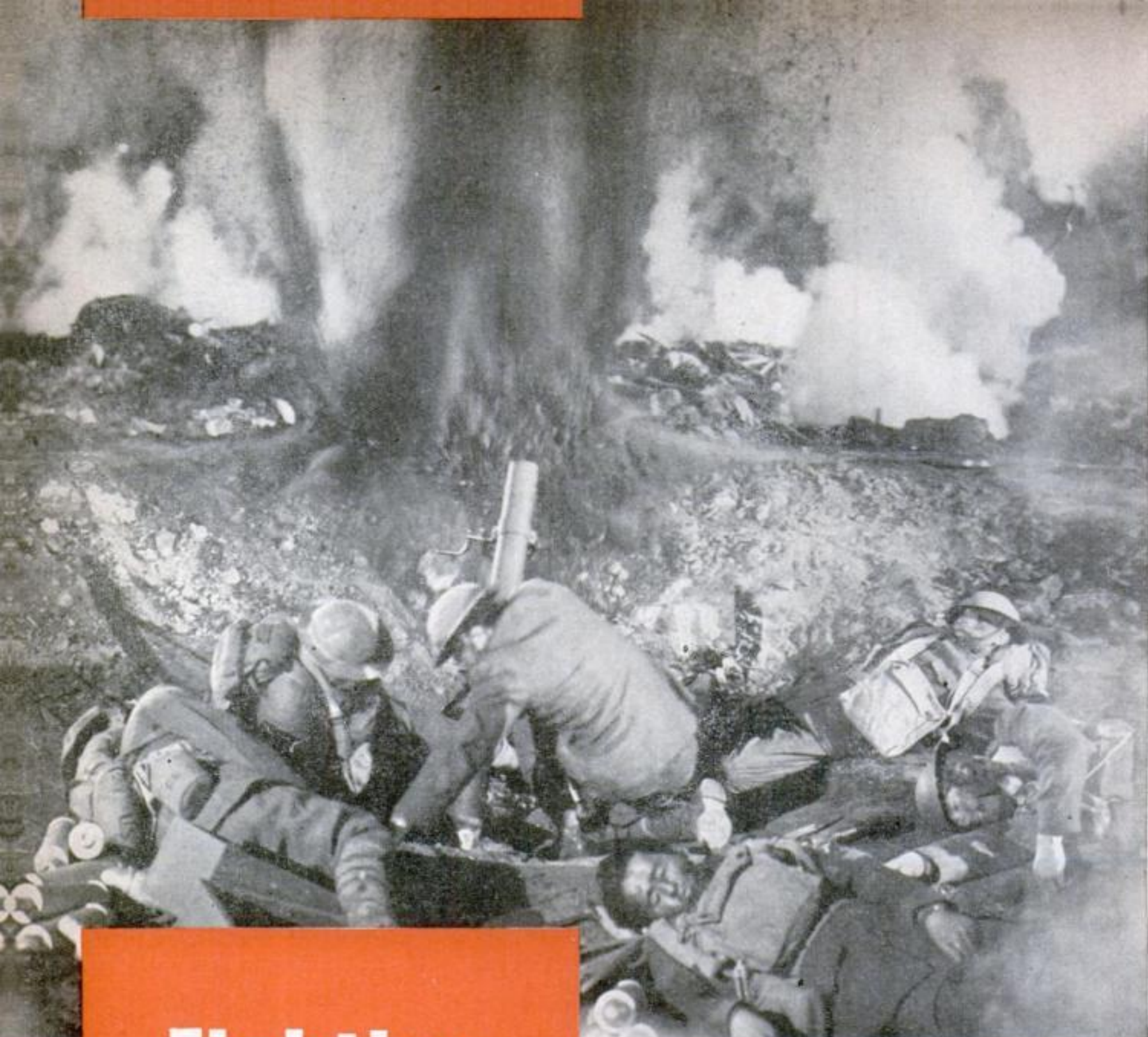
—copper disks resting on asbestos pads—must heat up at a standard rate in trials of oven broiling. A thermopile, resembling a microphone, detects how much warmth a radiant heater gives off in different directions. If defective burners emit deadly carbon monoxide gas, analysis of combustion products reveals it, and changes are ordered.



Samples of combustion products of gas burners being drawn off for analysis. Right, measuring warmth given off at angles by a radiant heater







# Fighting Wars For the Movies

HOW POWDER EXPERTS  
BRING NEW REALISM  
TO SCREEN BATTLES

By JOHN E. LODGE

A shell bursting in the ground, in a recent war film

SINCE 1918, nearly 250 movie battles have been fought among the valleys and hills north of Hollywood, Calif. To make realistic scenes for war films, guns boom, parachute flares light the countryside, and land mines shatter the night. Unlike the vast areas covered by troops in actual warfare, however, a Hollywood battlefield seldom spreads over more than a few acres. Directors plot camera angles carefully, and a few hundred khaki-clad extras and stunt men look like divisions when they go into action.

Recently, as troops moved across a trench-laced field into barbed-wire entanglements in making the new movie, "The Fighting Sixty-Ninth," their ghostly figures were bathed intermittently in the glow of near-by shell bursts. Gradually, as gun flashes lighted the sky beyond a near-by hill, the heavens glowed

POPULAR SCIENCE





Before going into battle, a movie soldier is given a realistic coating of mud applied by a make-up man with a broom

At upper right, James Cagney is being doused with make-believe blood for his big scene in "The Fighting Sixty-Ninth"

"Casualties" are provided in advance with realistic wounds and the glassy stare of death, as shown at the right

Because a fresh, clean uniform wouldn't look right in the trenches, the actors below are smearing themselves with mud







Dropping a dummy projectile into a borrowed U.S. Army mortar. A blank shotgun shell inserted in the projectile, as shown at right, hurls it into the air



with a brilliant and flickering white fire.

Studio electricians made the gun bursts with an ingenious lightning torch. Every three seconds, compressed air blew aluminum powder into the air, while an electric spark ignited the powder near the muzzle. Soon, as clouds of smoke rolled upward, the flashes illuminated a wide area to produce a startling visual effect of night firing. Sound representing the booming of the guns was dubbed onto the sound track later at the studio.

Movie battles are really fought before cameras begin to roll. Workmen, following carefully prepared battlefield diagrams, dig shell holes, stretch barbed wire, cut trenches, and spade up every foot of earth to give the appearance of land that has been fought over. Before film fighters attacked in the recreated Argonne Forest not

long ago, 1,500 powder bombs connected to central firing boards were laid in holes spotted over the field, 500 aerial bombs were attached to twenty- and thirty-foot steel poles, painted black to escape view by the cameras, and 450 pounds of dynamite was buried at strategic points. Before each "take" the troops rehearsed their movements, those cast as "casualties" falling at points indicated by the director.

"We take absolutely no chances," says Fred Ponedel, one of Hollywood's dozen expert powder men. "Some paper-wrapped



bombs are shot into the air from mortars, but most of the shrapnel effect comes from bombs tied to the poles. These consist of small drug-store cartons filled with flash and fine sporting powder. By wrapping the cartons tightly with bicycle tape, we get a quick, sharp flash and explosion."

"Shells" bursting in the ground present the greatest hazard, yet no one gets hurt, provided he follows instructions. Charges are buried in holes dug about three feet deep, either as a "V," which directs the force straight up, or by leaning the "V" to make one side vertical. By this means, the explosion can be directed where it is wanted. Dynamite, covered by cork and canvas-wrapped earth which mushrooms when it goes off, gives an effect of great force for the cameras.

One of the most spectacular effects shows barbed-wire entanglements zooming upward as high explosives drop in their midst. The wire is tied to soft yucca sticks and placed in short sections,

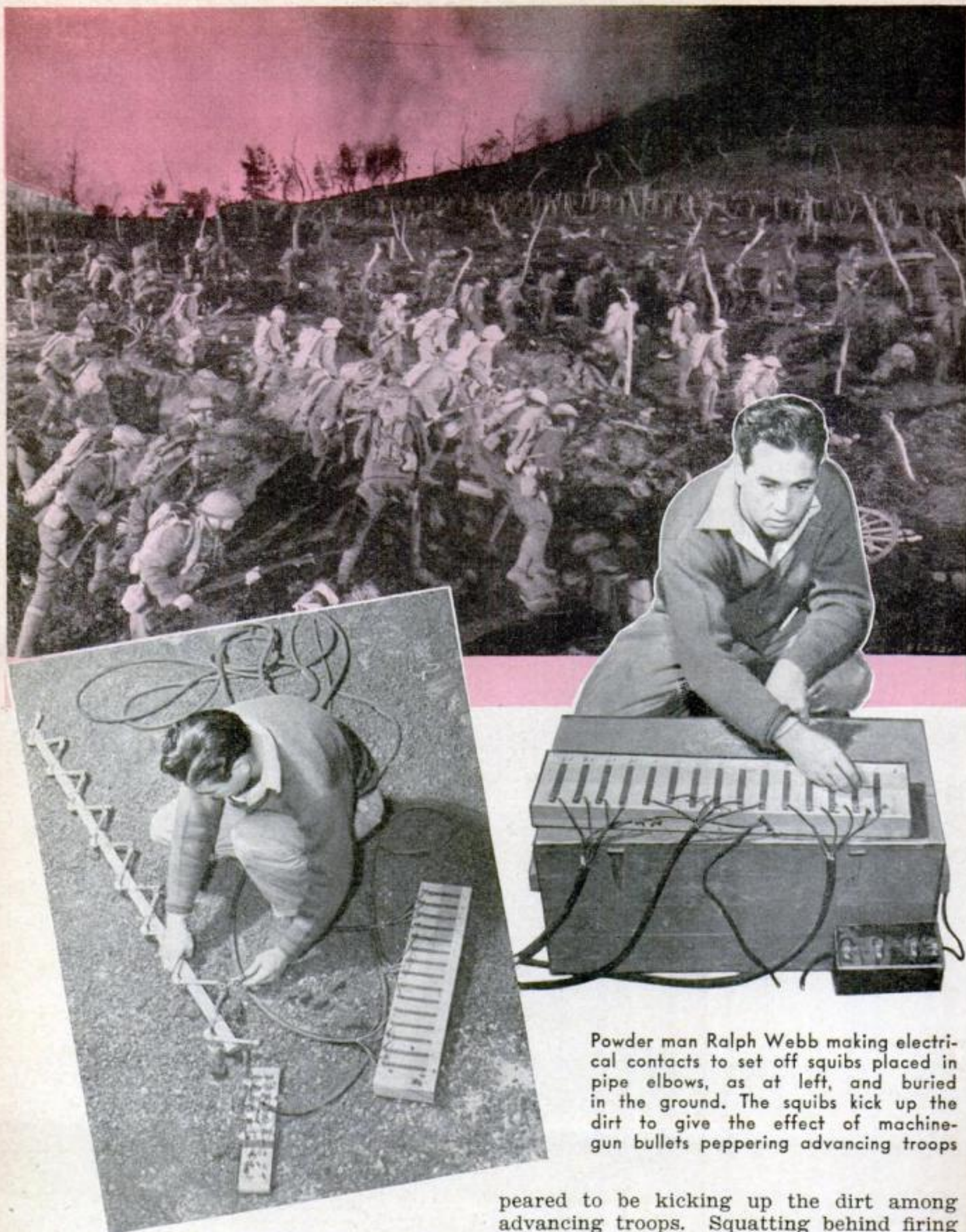
overlapping but not connected. As a movie barrage "rolls" into the wire, buried dynamite explodes, the sticks being covered by sacks directly underneath the poles, and away goes a mass of wire.

Big guns, howitzers, mortars, and machine guns roar and pop in many pictures, yet none actually fires a live shell. When possible, the movie makers borrow field pieces from near-by U. S. Army posts, firing blanks in them or using them as properties with which to dress the set. To get scenes of a soldier firing a Stokes mortar, a director

The explosion of a hand grenade is simulated by fuller's earth, cork, and umber thrown upward by the compressed-air apparatus at right







Powder man Ralph Webb making electrical contacts to set off squibs placed in pipe elbows, as at left, and buried in the ground. The squibs kick up the dirt to give the effect of machine-gun bullets peppering advancing troops

had the actor coached in the proper way to drop shells down the barrel. When shooting commenced, the gunner used dummies, to the rear of which blank shotgun shells were attached. These shot the projectiles upward with just enough force to carry them safely outside the scene. Land mines, touched off by electricity, represented the mortar bursts.

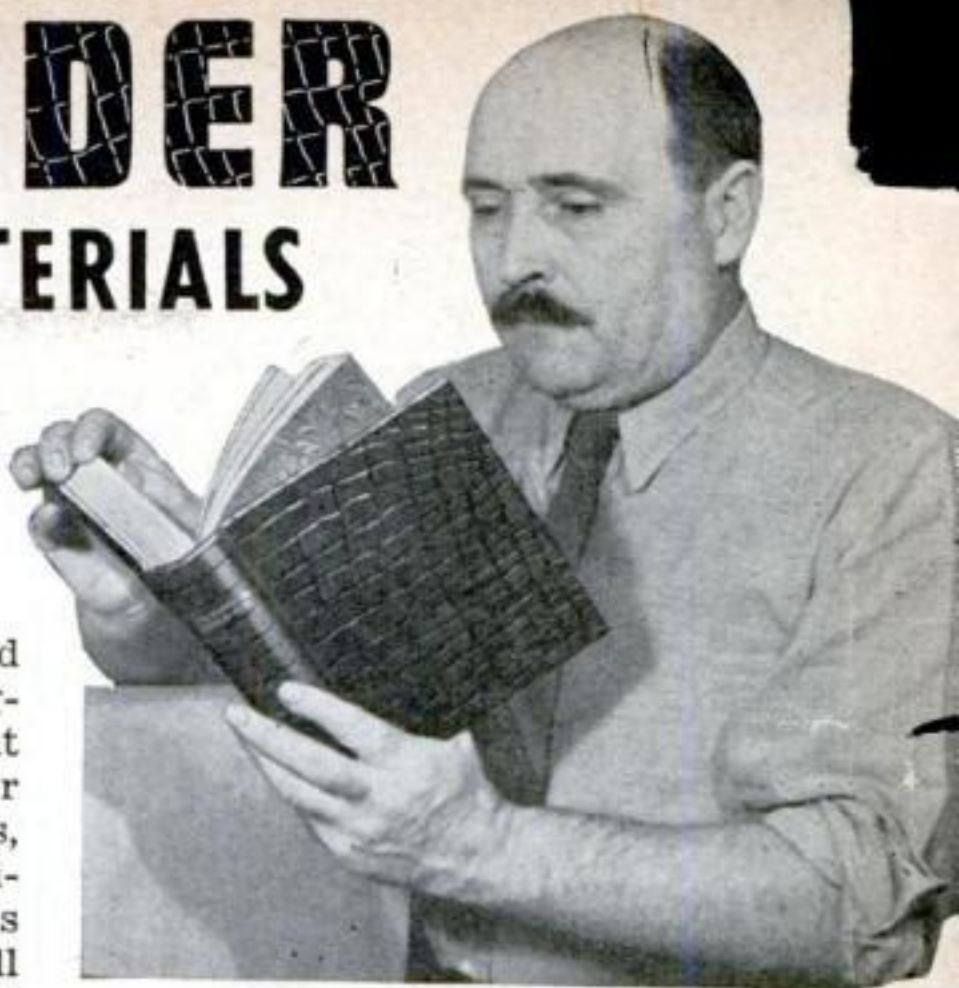
In a recent war film, machine-gun fire ap-

peared to be kicking up the dirt among advancing troops. Squatting behind firing panels, six powder men sprayed the battlefield with thousands of "bullets." As the soldiers moved forward in waves, the "gunners" watched them closely, and at intervals raked firing pins across strips of copper, closing electrical contacts to fire squibs buried two inches down in the ground. Each squib, containing five grams of powder, was fitted into an elbow of pipe, the elbows being spaced at (Continued on page 229)



# BOOKBINDER USES STRANGE MATERIALS

"YOU can't judge a book by its cover" is a saying that's not true of volumes bound by Maurice Hammenau, of Brooklyn, N. Y. For Hammenau, a former French soldier, adapts the cover material to the subject of the book he is binding, and he has used hundreds of odd materials ranging from elephant hide for a book about pachyderms, to the uniform of a soldier for a war novel. Skins from sharks, antelopes, zebras, lizards, poisonous snakes, lions, tigers, and horses are only a few of the pelts he has used for special bookbinding jobs. All his work is done by hand, and some of the problems he encounters in binding require great skill and patience. When he recently bound a book on elephants, for example, the ele-



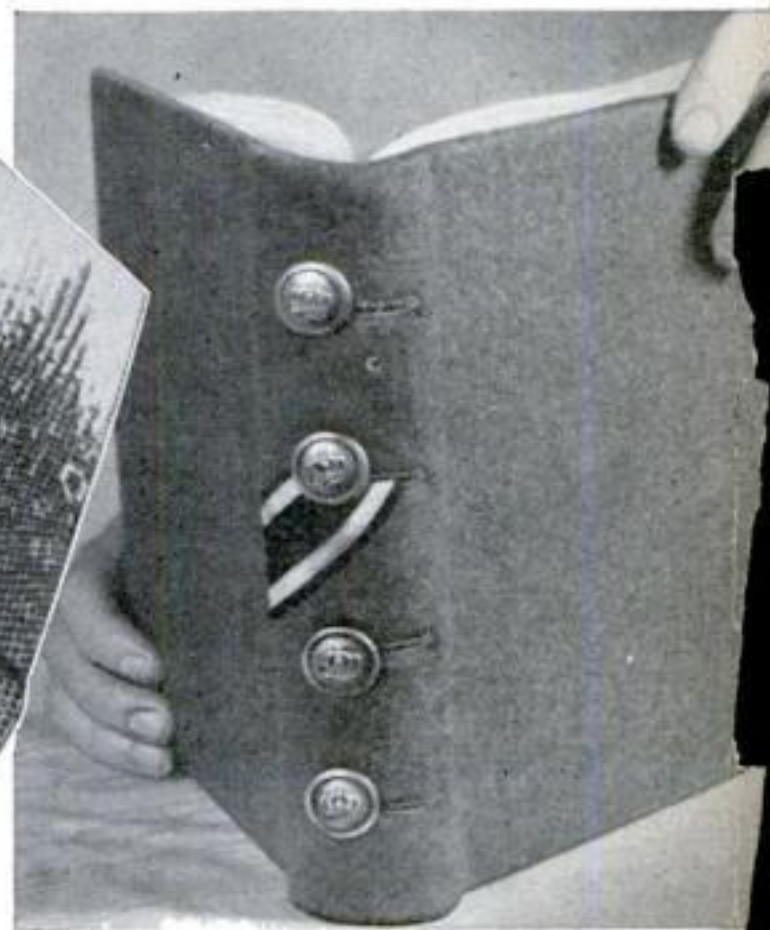
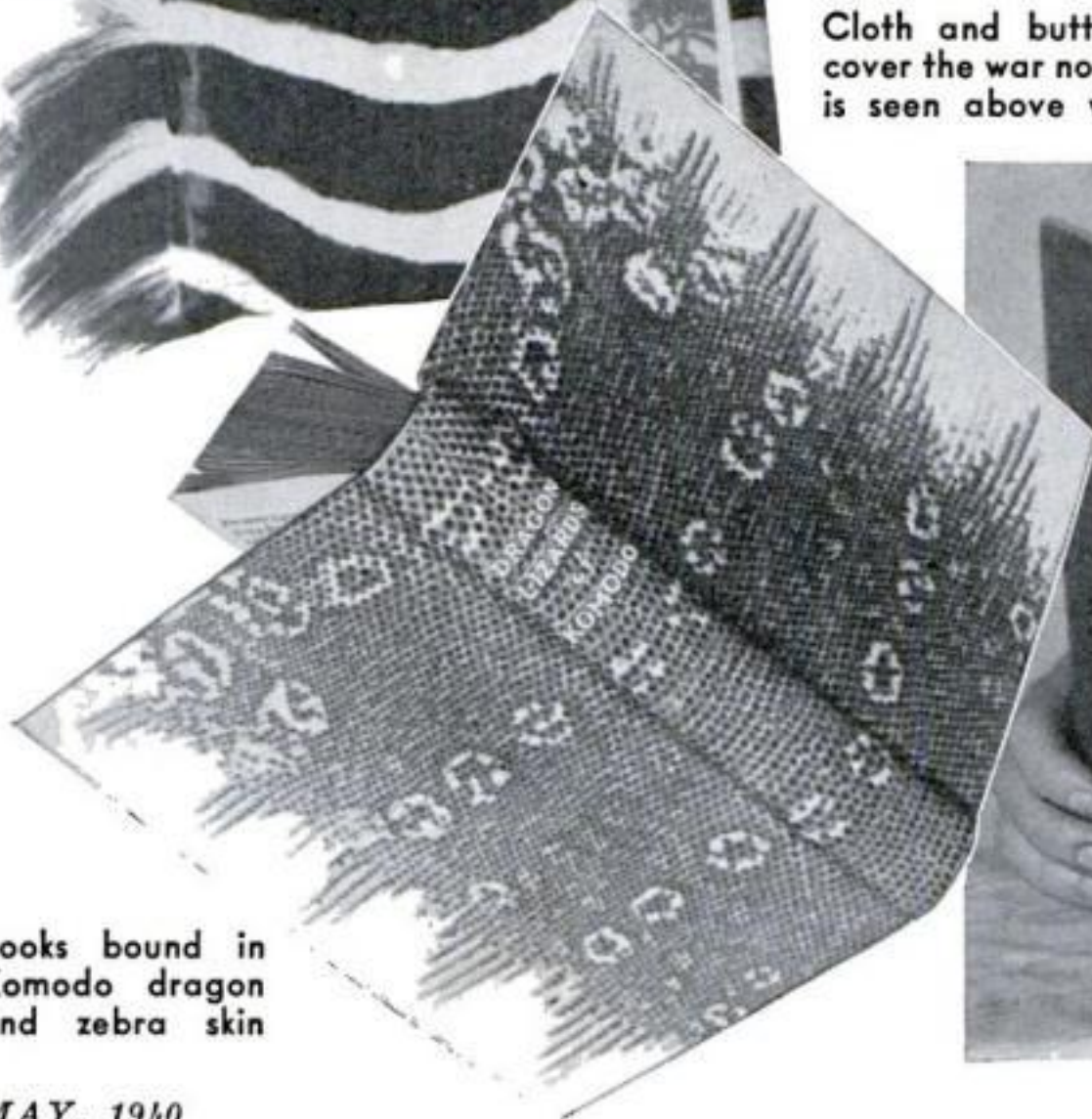
phant hide he secured was an inch and a half thick, much too bulky for the purpose. So he spent more than two weeks shaving the hide down to a thickness of less than half an inch, a job that had to be done entirely by hand because of the deep and even furrows in the elephant hide. Skin bindings also require special attention since they dry so quickly that they tend to pull out of shape the cardboard book cover over which they are placed. To keep them moist and allow them to dry slowly, Hammenau stuffs wet paper under the skin bindings when they are stretched over the cover boards. Pictures on this page show some of his bindings.

Cloth and buttons from a soldier's uniform cover the war novel below. Maurice Hammenau is seen above with an alligator-skin binding



Books bound in Komodo dragon and zebra skin

MAY, 1940





# CENSORED

When a censor gets through with a letter, it may look like this. All objectionable parts were blacked out



Snake-  
ention,  
nd to  
over  
ther  
He  
na  
A, mail bags ar-  
Orist headquarters  
For British postal  
ship in Liverpool.  
er letter and parcel  
examined thoroughly



OPENED BY

21th.  
Paper Service Monthly  
353. Fourth Avenue  
New York

U.S.A.

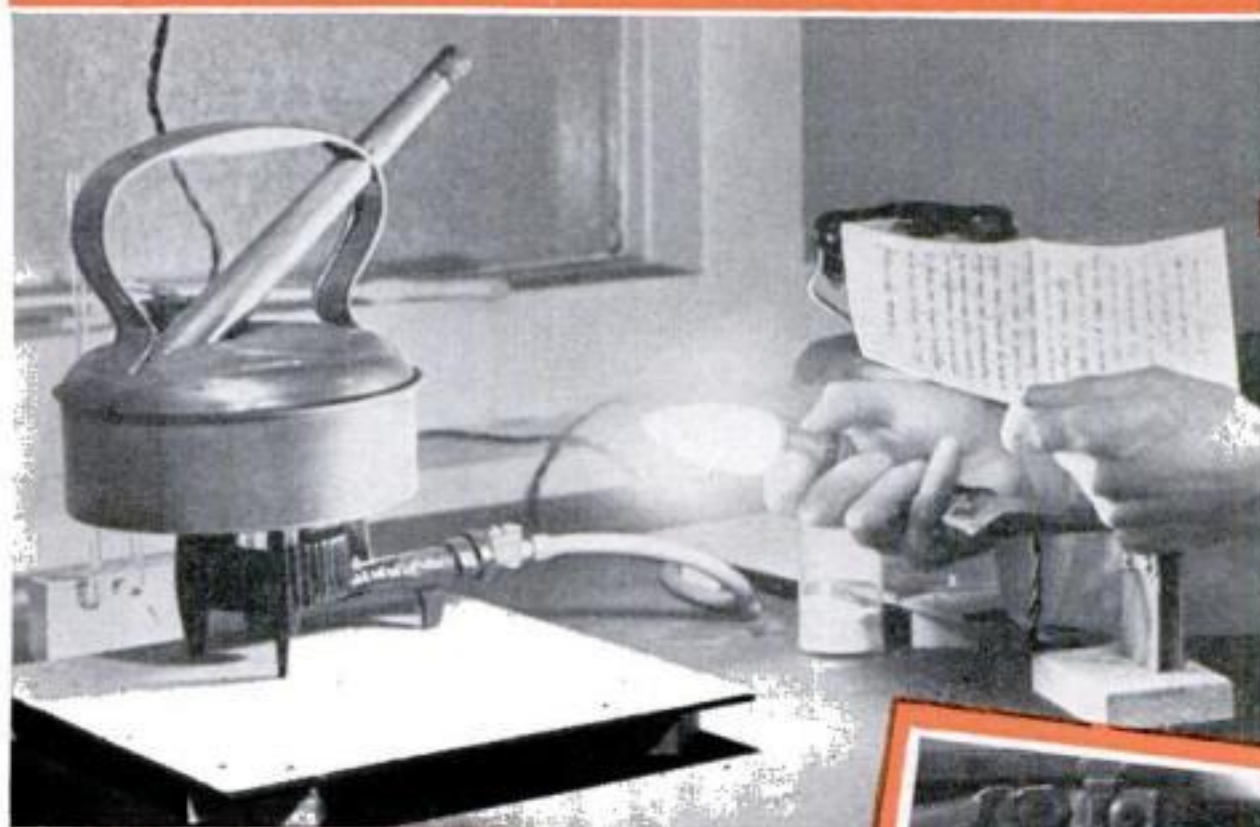


red letters are resealed and  
d with a sticker before they  
rwarded to their destination



## .... HOW NATIONS AT WAR SEARCH THE MAILS

At the front, military censors like the one at right read all letters written by soldiers to the home folks, to prevent "leaks" of news



Suspicious-looking letters are treated with steam and with chemicals to make sure that they do not contain writing in invisible ink

This suitcase, containing a foreigner's personal papers and correspondence, had to be opened for examination



**M**ORE than 100,000 letters, and hundreds of bulging mail bags full of parcels and bundles pass through the Liverpool headquarters office of the British postal censorship every day. An army of 2,000 clerks, readers, linguists, code experts, chemists, and other specialists is needed to comb this mass of mail, search out hidden information, delete statements that could be injurious to the British cause, and confiscate any material that might in any conceivable way be of value to the enemy.

A little known but vitally important adjunct to war, this censorship activity goes on ceaselessly in every belligerent nation. At the battle front, military censors read the home-bound mail of soldiers, deleting mili-

tary information of any kind. At home, every letter addressed abroad goes first to a censoring depot to be thoroughly scanned by a trained expert before it is released. Questionable statements in letters are blacked



out with opaque ink, no matter whether they refer to such a minor point as the state of the weather—a factor that might have some effect on military aviation activity—or whether they convey information about troop movements.

Practically nothing escapes the sharp-eyed censors. A seemingly innocent note may contain vital military secrets written between the readable lines in invisible ink. Steam and chemical treatments will bring the writing out. Other apparently harmless notes may conceal a code. Postal cryptographers solve it. Spies may stuff a message within a cigarette. A censor clerk turns it up by probing the cigarette with a hatpin. Letters written in foreign tongues are translated and scrutinized by a corps of linguists. Contraband goods that might reach the enemy through neutral countries are confiscated. Valises, trunks, and other baggage are emptied, and their contents as well as the containers themselves, are minutely studied.



At top, an expert is probing a cigarette with a hatpin to make sure it does not conceal a message. Sometimes, documents are photographed, above, to provide the censors with a permanent record of their contents

## Plane Cabins Have "Defroster" Windows



Area covered by extra glass pane is always clear of fog

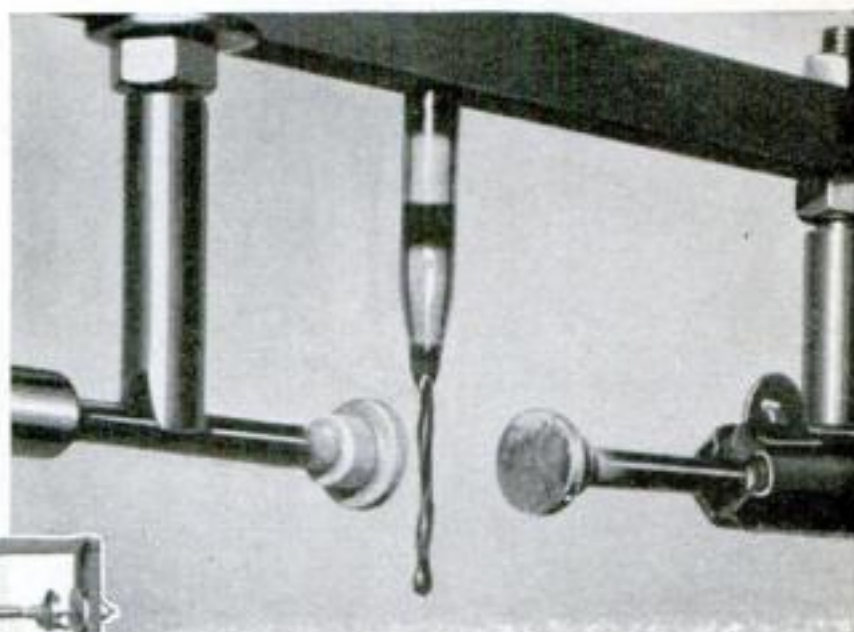
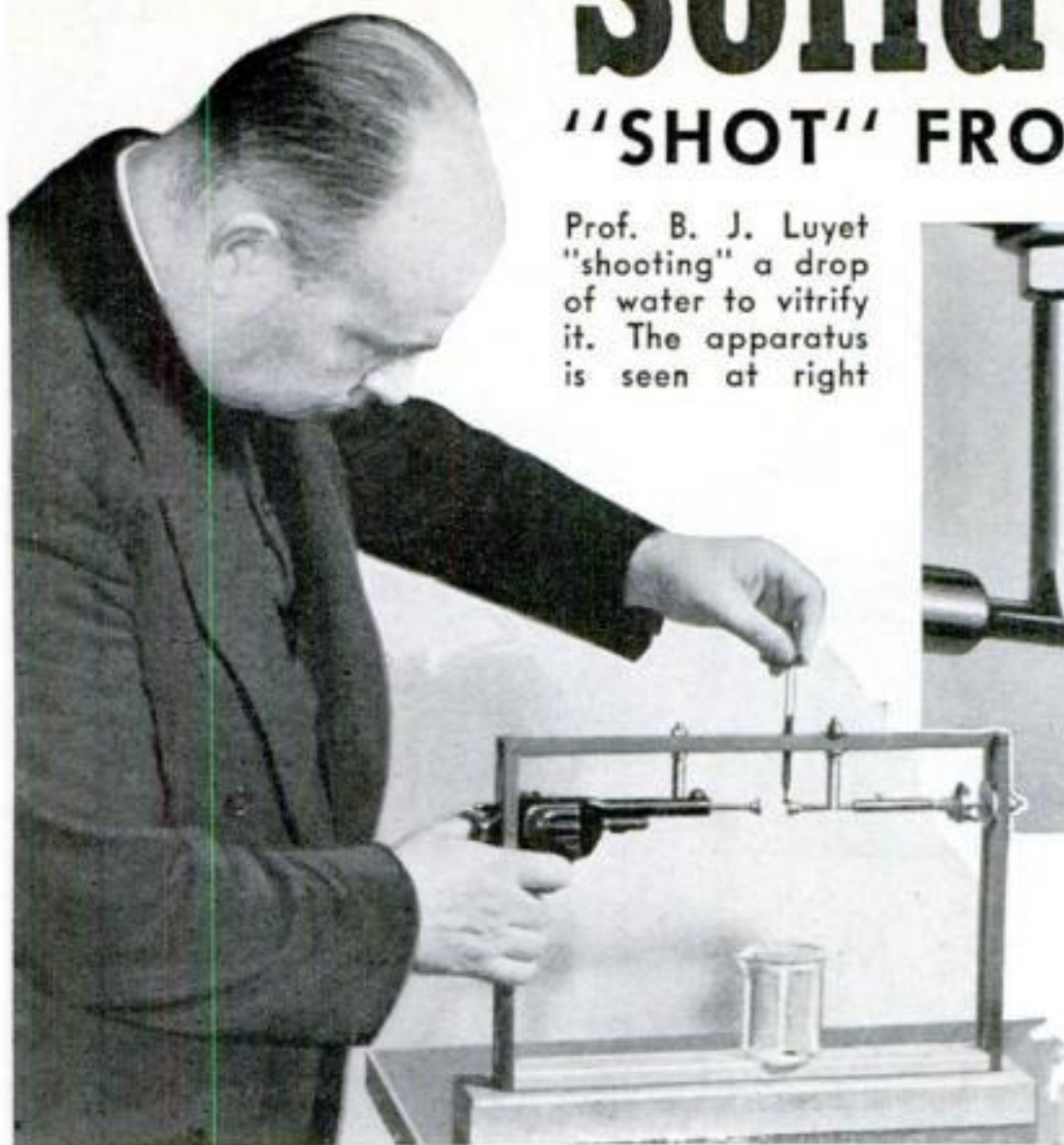
TO ENABLE passengers to see out in all kinds of weather, a leading transcontinental air line has equipped its planes with "defroster" windows. A removable second pane is attached to the regular window glass, in such a manner as to leave a dead-air space between. This prevents fogging of the glass under certain weather conditions, and insures clear visibility at all times. In the photograph reproduced at the left, an air-line stewardess is pointing out the fogproof window and explaining its purpose to a passenger. All passenger windows on transcontinental planes of this line are so equipped.



# Solid Water

## "SHOT" FROM TOY PISTOL

Prof. B. J. Luyet "shooting" a drop of water to vitrify it. The apparatus is seen at right



that ice crystals had no time to form.

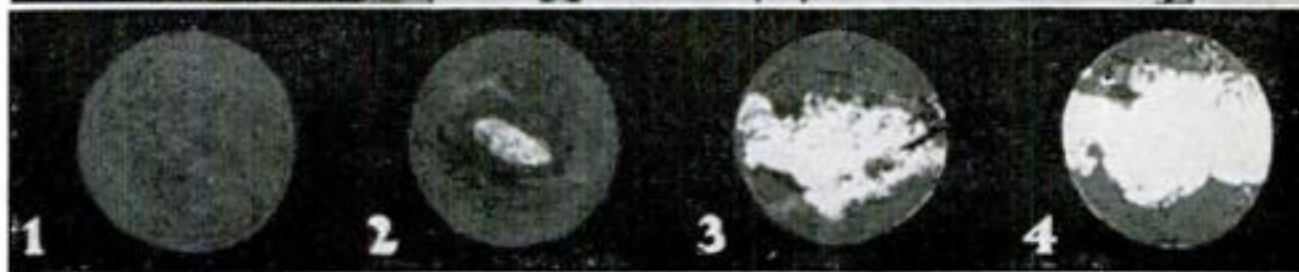
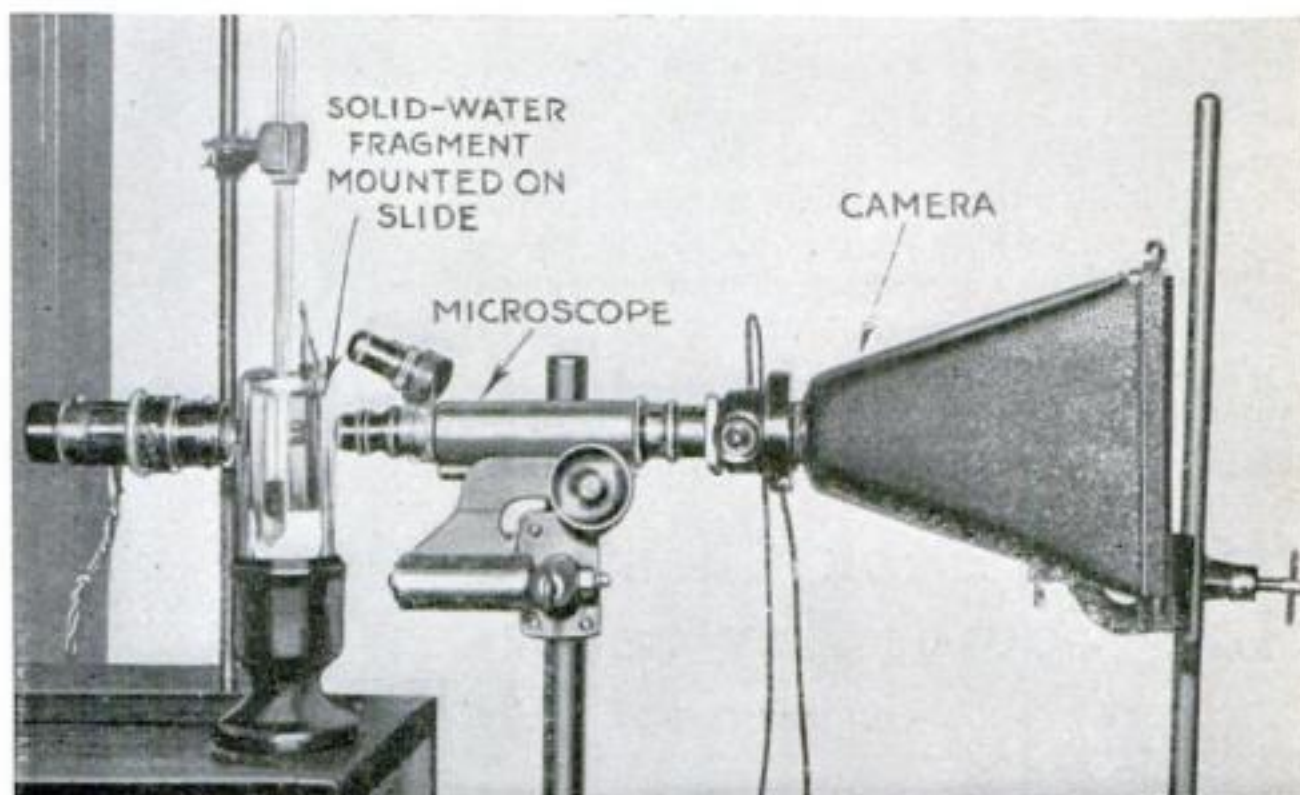
To show this, Dr. Luyet transfers a fragment of "solid water" on chilled glass to a microscope fitted with crossed polarizers—optical "valves" arranged to transmit no light unless crystals are present. At once, the dark field proves the specimen vitrified, or non-crystalline like glass, rather than crystalline like ice. Let it warm up slowly, and growing crystals show it gradually turning into natural ice before it melts.

IT'S as hard and cold as ice—but it isn't ice, nor is it anything that has ever existed before. That strange description fits "solid water," produced with the aid of a child's toy pistol in an experiment by Dr. B. J. Luyet of St. Louis University, St. Louis, Mo.

When he presses the trigger of the spring-and-plunger pistol, a trickle of ordinary water from a medicine dropper is flattened between two brass disks, which have been pre-cooled in liquid air. A glassy film of solidified water remains adhering to the metal. It was frozen so suddenly

### TAKING PICTURES OF SOLID WATER

The photomicrographs at right, made with the polarized-light set-up illustrated, show how ice crystals appear in a slice of solid water as it is allowed to warm







## Snake Is Treated for Sore Throat

WHETHER it's caught the "flu," or has tried to swallow a baby porcupine, the snake in the picture below has a mighty sore throat. So Harry Jackson, in charge of reptiles at a Fort Worth, Tex., zoo, is shown swabbing its gullet. An epidemic of the ailment has kept him busy playing doctor.



## New Device Tenderizes Meats

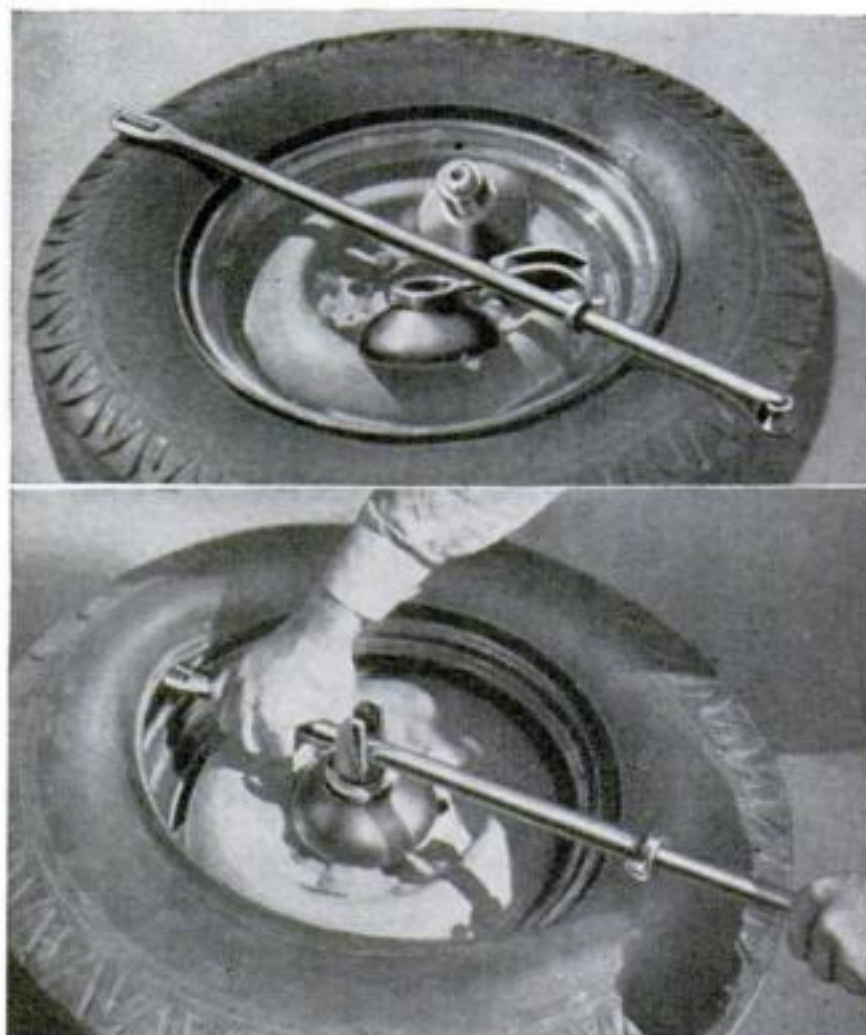
FIFTY-EIGHT sharp blades quickly make meat tender, without squeezing out juices, in a new electric machine. The device cuts all veins, sinews, and fibers, and handles all meats including beef and pork tenderloin up to an inch and a quarter thick. It may also be used to knit together slices or strips of beef, pork, veal, or mutton.

## Tool Makes Quick Job of Removing Tire

AS MANY as four tires a minute can be demounted by an experienced operator with a new auto tool, according to its San Bernardino, Calif., inventor. The four-piece device consists of a cone inserted through the wheel, a bell which is screwed to the cone from the other side of the wheel, a swivel set in a hole at the center of the cone, and a long bar placed in the fork of the swivel to remove the tire as illustrated. With this implement, it is declared virtually impossible to damage either tire or tube.

## Scientists Seek Chemical That Causes Hay Fever

HAY-FEVER sufferers may find relief through the researches of scientists at Johns Hopkins University, Baltimore, Md., who are trying to determine just what chemical in ragweed pollen is responsible for the sniffles and sneezes of late summer. If the culprit can be identified, it may be possible to make hay-fever victims immune to it.



Parts of new tire remover, and the tool in use. As the bar is rotated, tire bead is pried off the rim

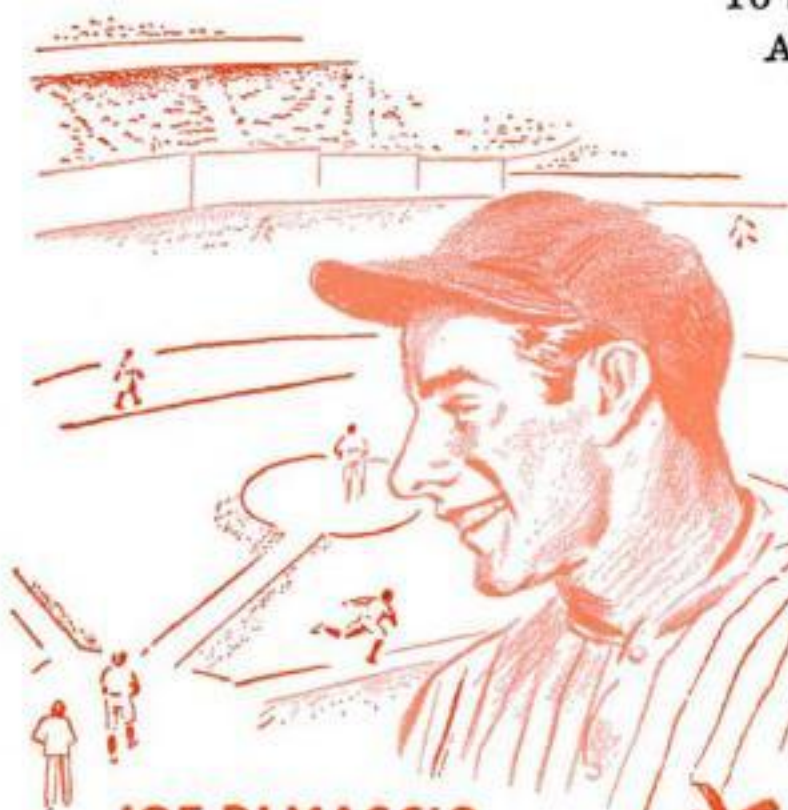


# Use What You've Got

By **BERTON BRALEY**

Men don't own equal talents,  
So why assert they do?  
For genius can outbalance  
The work of me and you.  
Some men are bound to top you  
A little or a lot,  
But still that needn't stop you  
From using what you've got  
To show a bit more ardor  
And generate more zest  
And try a little harder  
To be a little better  
And get a little farther  
Than the rest.

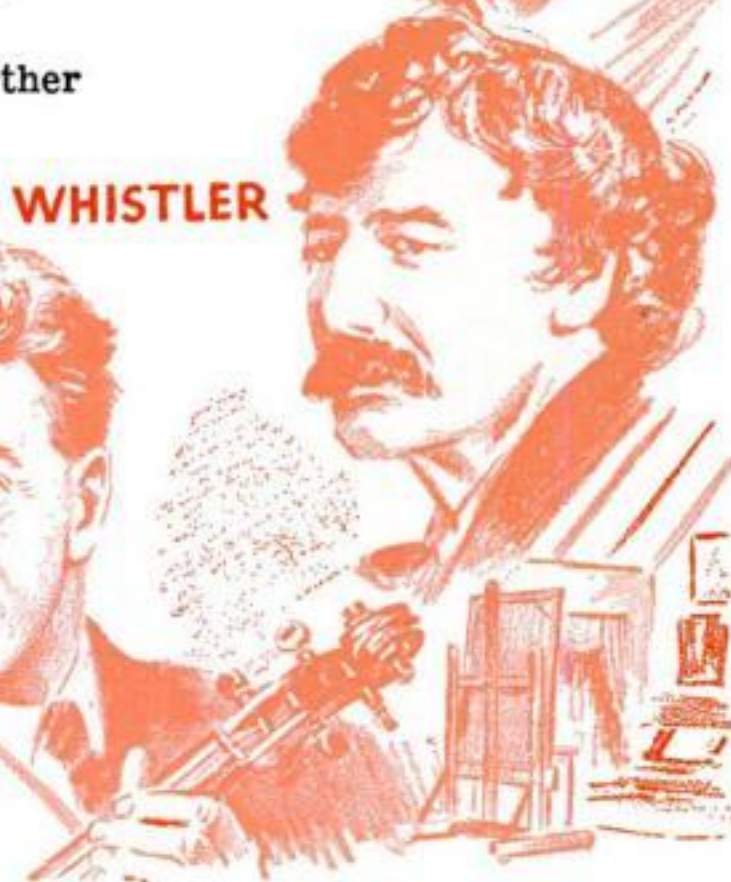
You may not light the skyways  
With brilliance—like a star;  
But on the mundane highways  
You'll travel pretty far  
And find that you are moving  
Upon an upward slope,  
Your life and jobs improving  
In richness and in scope,  
With plenty in the larder  
And money in the vest,  
Because of trying harder  
To be a little better  
And get a little farther  
Than the rest!



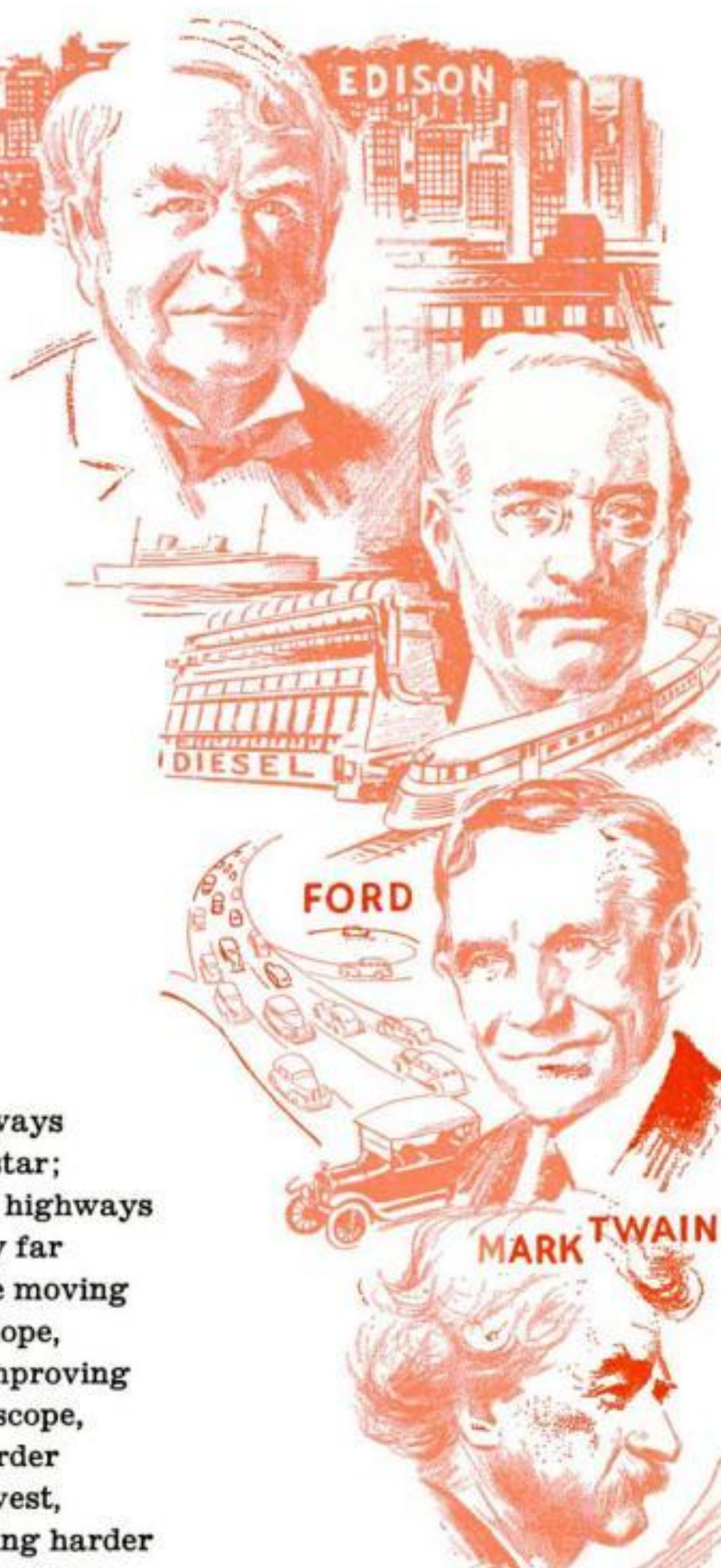
**JOE DI MAGGIO**



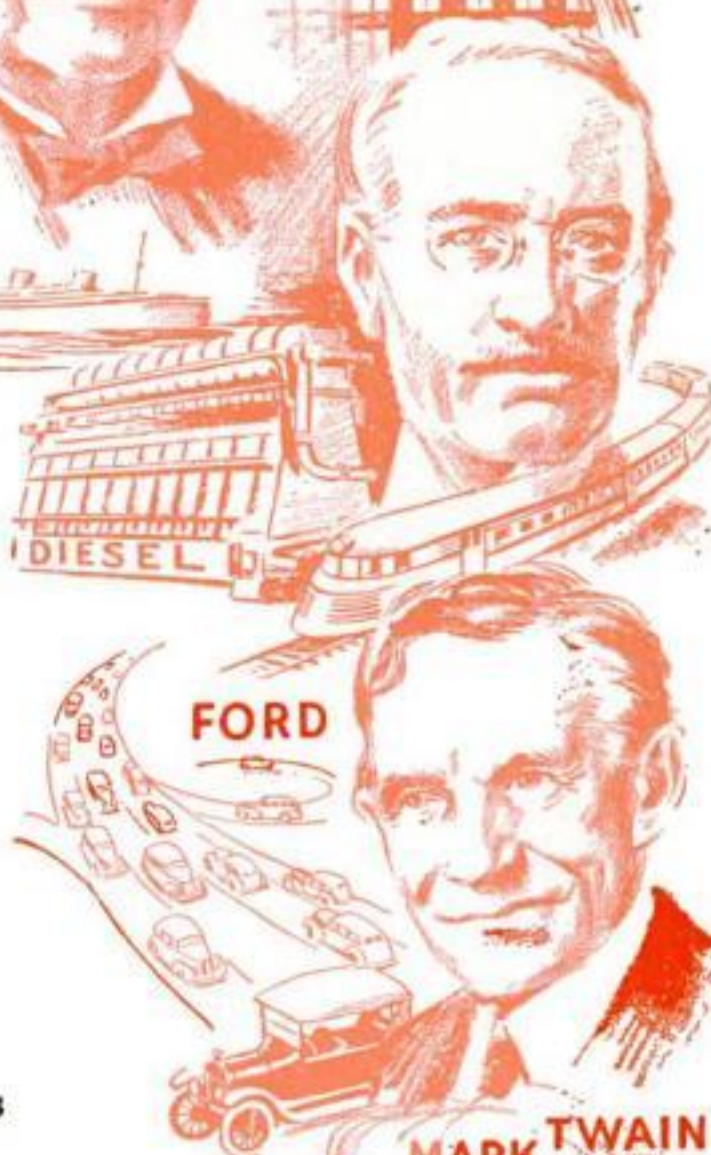
**KREISLER**



**WHISTLER**



**EDISON**

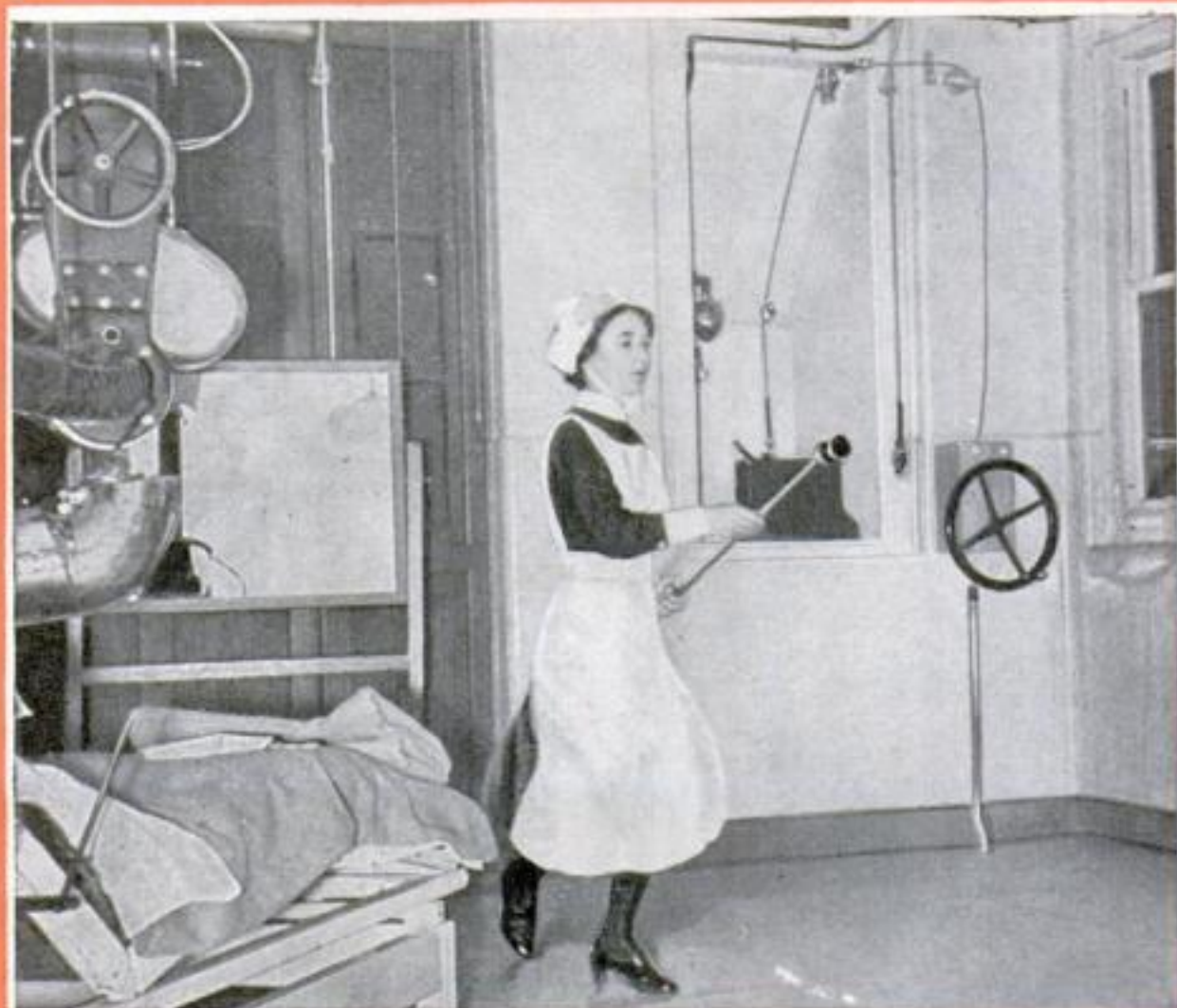


**FORD**

**MARK TWAIN**



# AIR-RAID SHELTER



When air-raid sirens sound, the radium is rushed from the machine to its lead container, at right



**Vault Beneath Hospital  
Guards Its Potentially  
Dangerous Store of the  
Costly Cancer Remedy**



# FOR RADIUM

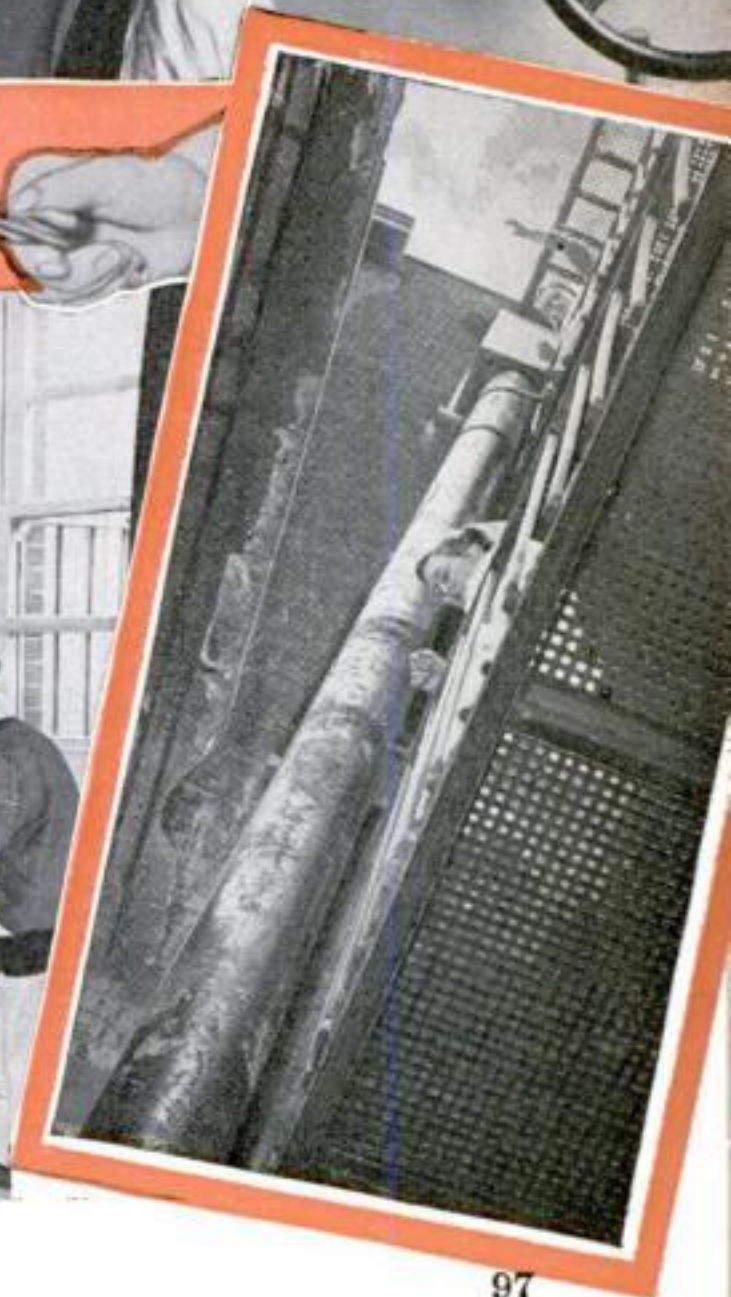
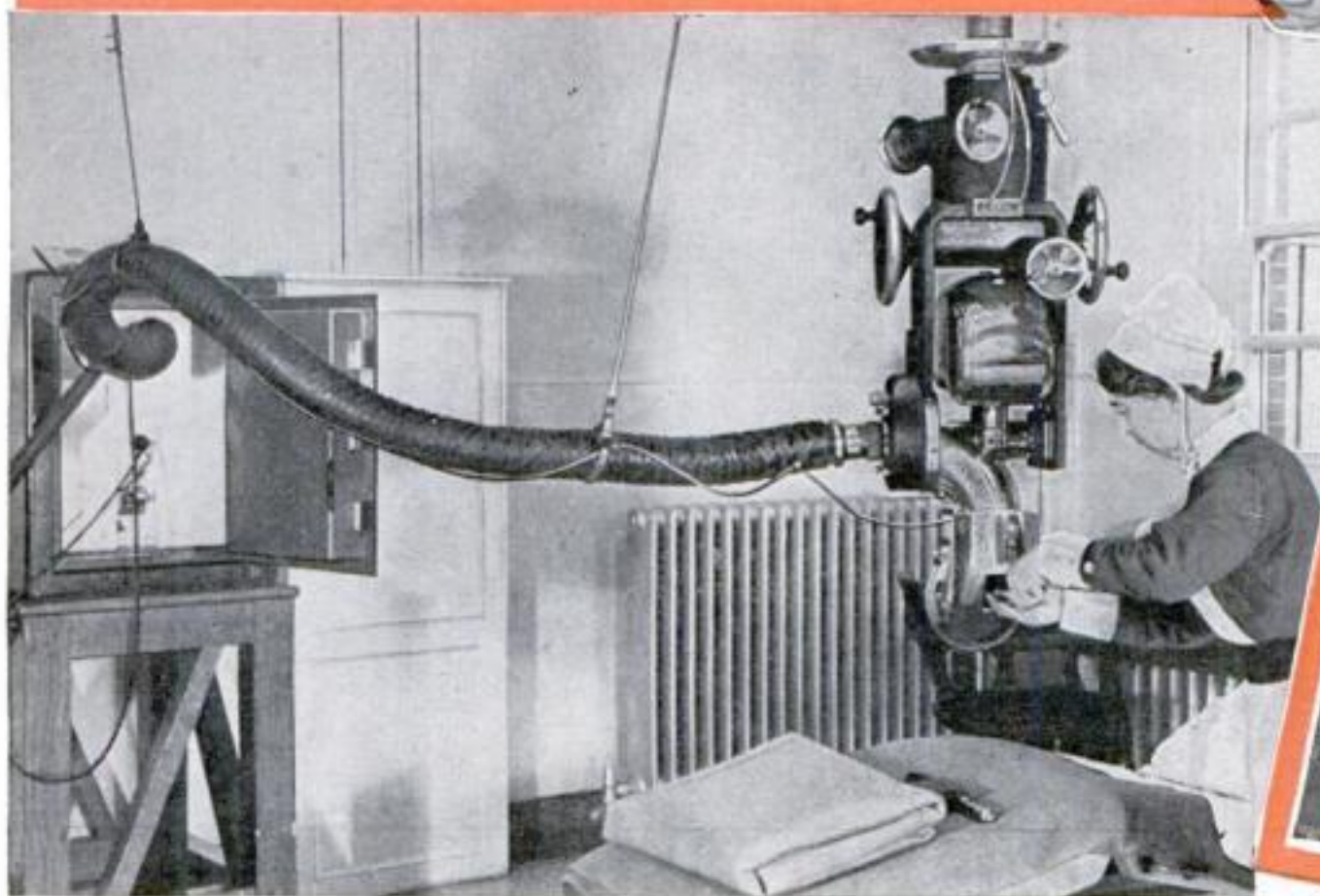
**B**ECAUSE their five grains of radium, scattered over a broad area by a direct hit from an aerial bomb, would create widespread disaster through deadly, uncontrolled radiations, officials of the Royal Cancer Hospital, in London, England, have devised an ingenious system for whisking their \$200,000 supply to safety within two minutes. If sirens scream an air-raid alarm, nurses rush the radium hoard to a lead cylinder hanging outside a window of the treatment room. By whirling the crank of a hand-powered winch, a nurse lowers the cylinder on a wire cable down a metal chute built against the outside of the hospital. At the end of its descent, the radium rests in a subterranean bombproof vault, forty feet underground.

While any threat of air raids continues, hospital authorities have ordered that the precious chunk of radioactive metal be lowered underground for storage every night. Before radium treatments can be started in the morning, therefore, the supply is raised through the shaft to the treatment room. A nurse then quickly transfers it to a



At the right, a nurse is lowering the radium into the tube to the underground vault. The container is handled on a rod

Placed in the "bomb" as shown below, the radium can be shunted between safe and apparatus. Right, the tube leading to the vault



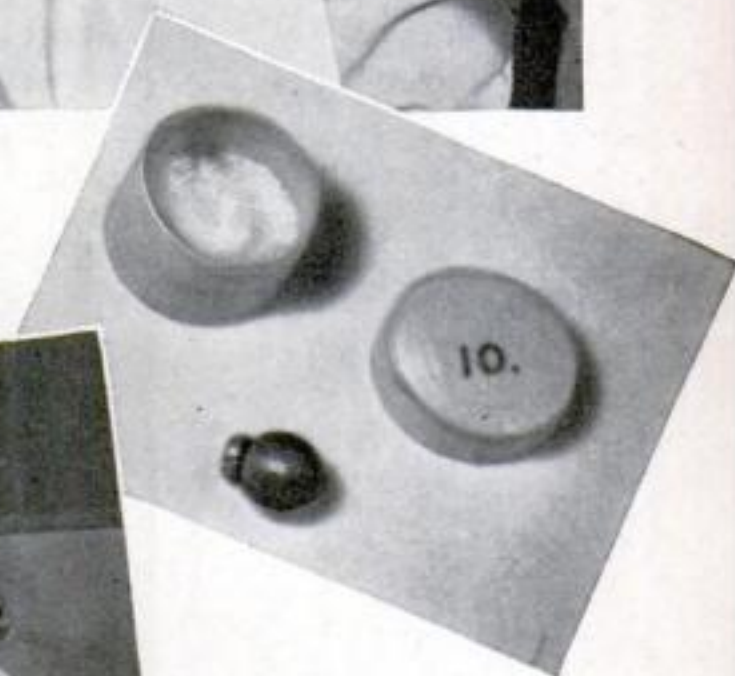


storage safe, which is inclosed in a 500-pound lead casing to keep radiations from escaping.

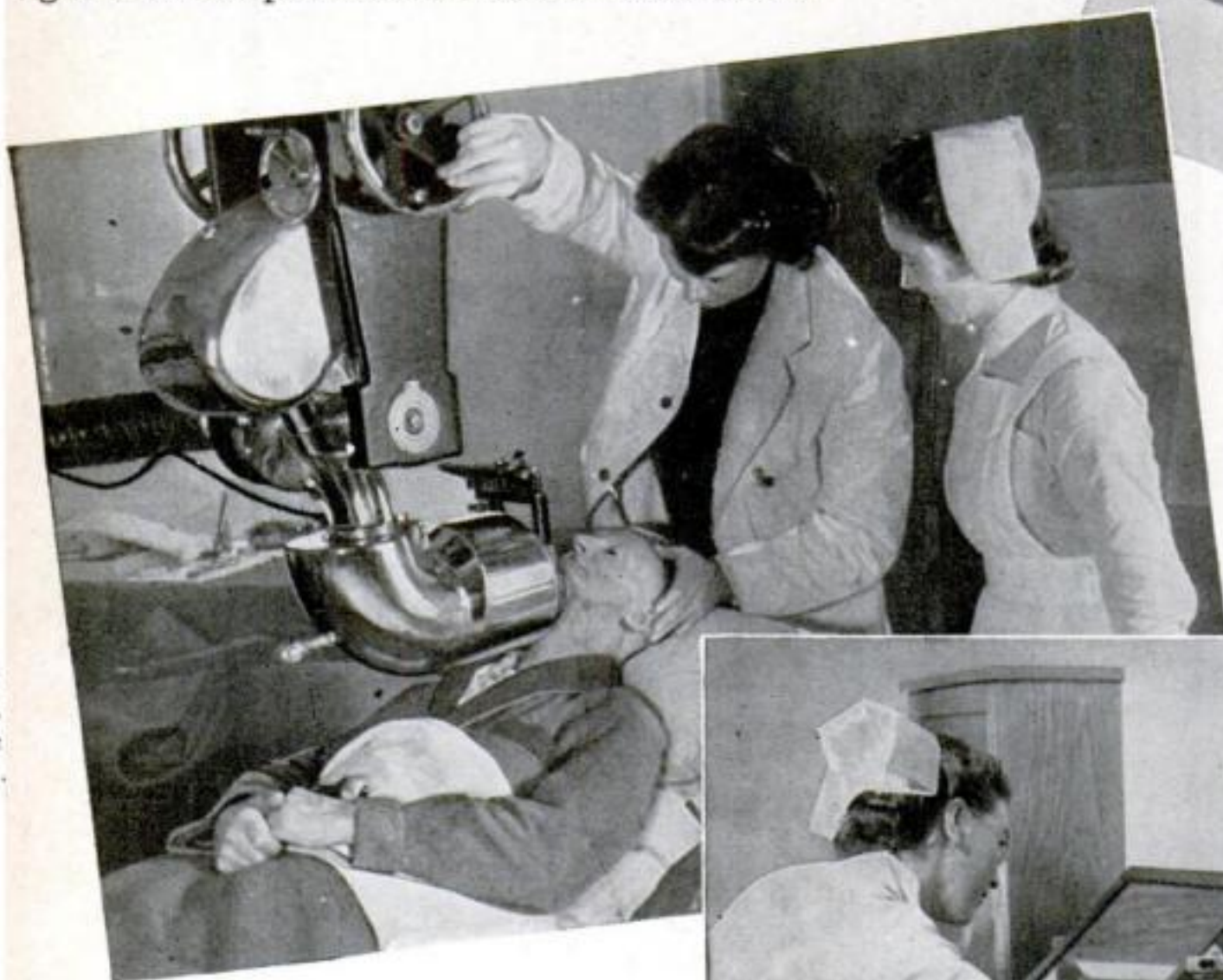
When a patient is to be treated, he is brought to the room and laid on a padded table. The radium-treatment machine is then adjusted and moved into place so that the radiations will be directed onto the proper part of the patient's body. In his hand he holds an electric signal button so that he can summon help if necessary. Nurses and doctors then leave the room.

Outside, an attendant at a control panel looks into a periscopelike arrangement of tilted mirrors that provides a view of the patient in the adjoining room. If everything is in order, she flips a switch. Automatically, an air-pressure system is set in operation to blow the container of radium from the safe through a flexible tube into position in the treatment apparatus. A special clock times the treatment. At the end, the attendant flips the control switch once more, and the radium is sucked back into its lead storage chamber.

For their protection, each of the nurses on radium-treatment service in the hospital is given a tiny bomb-shape recorder which is carried in a uniform pocket. This recorder is sensitive to radium radiations, and gradually becomes radioactive itself after exposure. By checking the recorders, the nurses are guarded against overexposure to the radium emanations.



A bomblike radiation recorder like the one above is carried by each nurse in a numbered container in a uniform pocket. This guards against overexposure to radiations



While a patient is being prepared for a treatment, the radium container remains in a lead-walled safe. When all is ready, attendants leave the room and the radium is shot into the apparatus. After treatment, pressing a button returns it to safe





# One-Man Magazine Is Unusual Hobby

SPREADING good cheer and encouragement by editing, printing, and distributing a monthly magazine is the laudable hobby of Charles Edward Caswell, of Concord, N. H. Devoted to witty sayings, wise observations, and words of encouragement and cheer, the tiny magazine is distributed without charge, its cost of publication and distribution being borne largely by donations from persons who have found it helpful and encouraging. In an upstairs room in his home, Caswell writes and edits copy, sets it in type, and prints it on a hand press. The publication is sent to every state and to fourteen foreign countries, going to individuals and institutions.



Charles E. Caswell printing an issue of his private magazine, "Friendly Cheer," a copy of which is seen at the left. At far left, the publisher-author-editor is at work at the ancient typewriter on which he does his writing

## Flexible Derby Can Stand Hard Knocks

Careless sitters, the nightmare of derby wearers, hold no terrors for this bowler



SIT on it, punch it, crush it between your hands—and a new derby hat just placed on the market is said to resume its original bowler shape and show no signs of its ill treatment. It looks like any standard derby and tips the scales at about the same weight, but, its makers say, it is far better able to withstand the hard knocks of daily wear than the "iron hat" now widely worn.



# Movie Animals "Made Up" as Prehistoric Beasts



Costumed as a mammoth, an elephant provides a new thrill for the screen

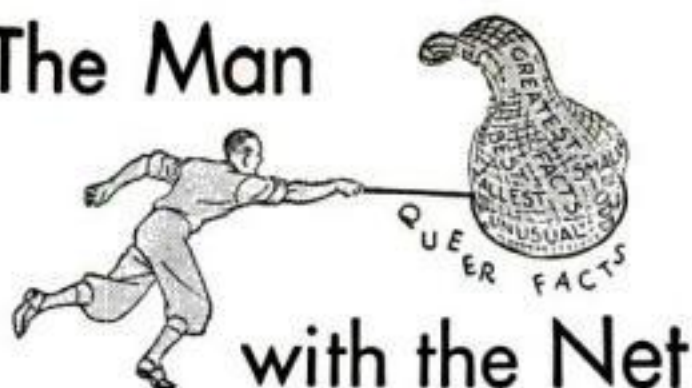


**B**LANKETS of crepe hair, and horns or tusks of soft wood transformed tame Brahma steers into musk oxen, and plodding circus elephants into prehistoric woolly mammoths, for scenes in "1,000,000 B.C.," a motion picture made recently. Before each day's shooting began, cowboys and Hollywood animal handlers made up the modern animals to resemble their ancient forbears, adding strands of plaited black hair to their heads in addition to the hair blankets and false tusks. Native trees were fitted with balsa-wood thorns. The picture portrays the struggles of the cave men.

Cow hands make up a Brahma steer to represent a prehistoric musk ox



## The Man



with the Net

**TWO HUNDRED** miles of roots were found attached to one two-foot clump of Canadian prairie grass.

**MOOSE** antlers, during their rapid growth, are edible. Indians of British Columbia boil and eat them.

**SHELLS** from big seacoast guns continue to gain speed for twenty yards after they leave the muzzle of the cannon.



**CANDLES** were used in lighthouses as late as 1787.

**GOLDENROD** has approximately eighty species in America, only one in Europe.

**SEAWEED** takes the place of spinach in the Eskimo's diet.

**GEORGE MARSHALL**, a worker in a Detroit factory, has driven 1,000,000 automobiles.

**OLDEST** land surface on earth is that of Australia.



**INCUBATORS** that turn over the eggs, just as a brooding hen does, have been devised by scientists of the U. S. Department of Agriculture.

**HEART DISEASE** affects more men than women; more professional men than laborers; more Negroes than whites.

**ONLY** the white race has both straight and kinky hair; all other races have either one or the other.



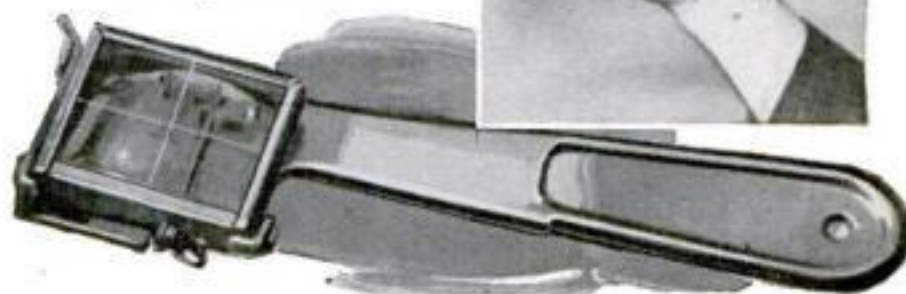
## He Trains Monkeys for Their Monkey Business

TRAINING monkeys to perform tricks is the odd occupation of Col. A. D. Dawson, of Louisville, Ky., who operates what he describes as the only monkey school in the United States. At one time, he says, almost all of the monkey assistants to the nation's organ grinders received their education in his back-yard school. Once they learn a trick, Dawson claims, they never forget it.

## Homemade Scene Viewer Aids Landscape Artist

CONCEIVED by James Oliver Hogg, a Chicago, Ill., landscape artist, the instrument pictured below is useful to painters for examining and studying a scene to be drawn. Consisting of a camera-type view finder fitted with a metal handle, the instrument allows the artist to see a scene right side up, in natural color, and reduced to the approximate shape of the canvas he intends to paint.

A camera view finder and part of an old paint scraper make up the device



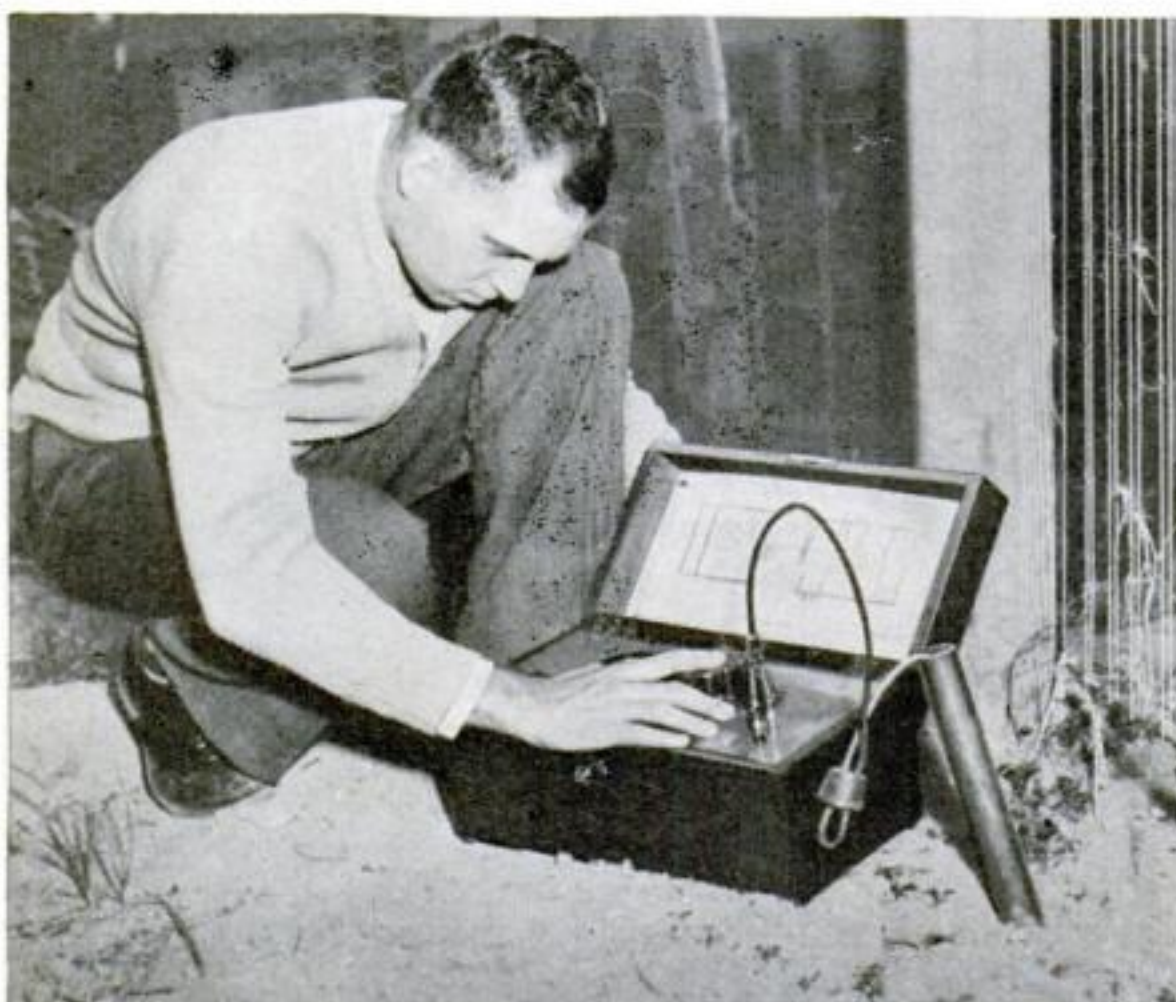




Members of the world's only artillery regiment that actually carries its guns

## These Soldiers Use Their Heads

AFTER one glance at the accompanying photographs, no one can say that native soldiers in a British African regiment don't use their heads! Taken at Zaria, in Nigeria, the photograph above shows a crew of native artillerymen toting a field gun on a wooden framework that rests on the soldiers' heads, which are protected by soft pads. At the left, a six-foot-four native fighter is pictured carrying the wooden wheel of a gun carriage by balancing it on his head. The system speeds mobility, particularly across sandy terrain.



Adjustable dials on the portable unit quickly measure soil moisture

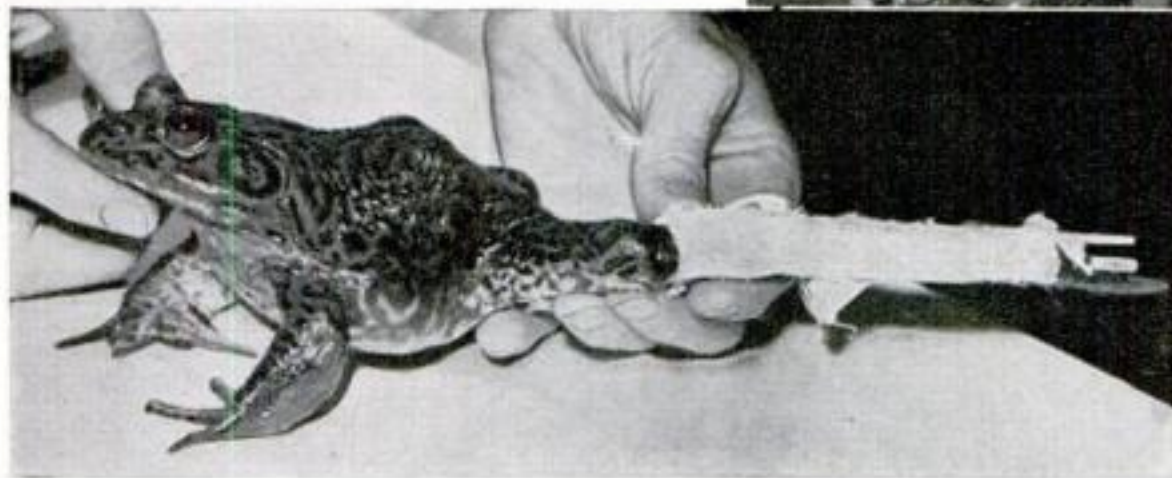
## Radio Device Tests Moisture of Farm Soil

How much moisture is in the ground, a factor particularly vital to farmers on irrigated land, can be determined in a few minutes by a portable electrical device worked out by conservation experts at the University of Arizona, in Tucson. Employing radio-broadcasting principles in its operation, the outfit is said to determine moisture content with a margin of error of only one percent. For tests, the cylinder-shaped unit is partly buried.



## First Aid for Frogs at Novel Hospital

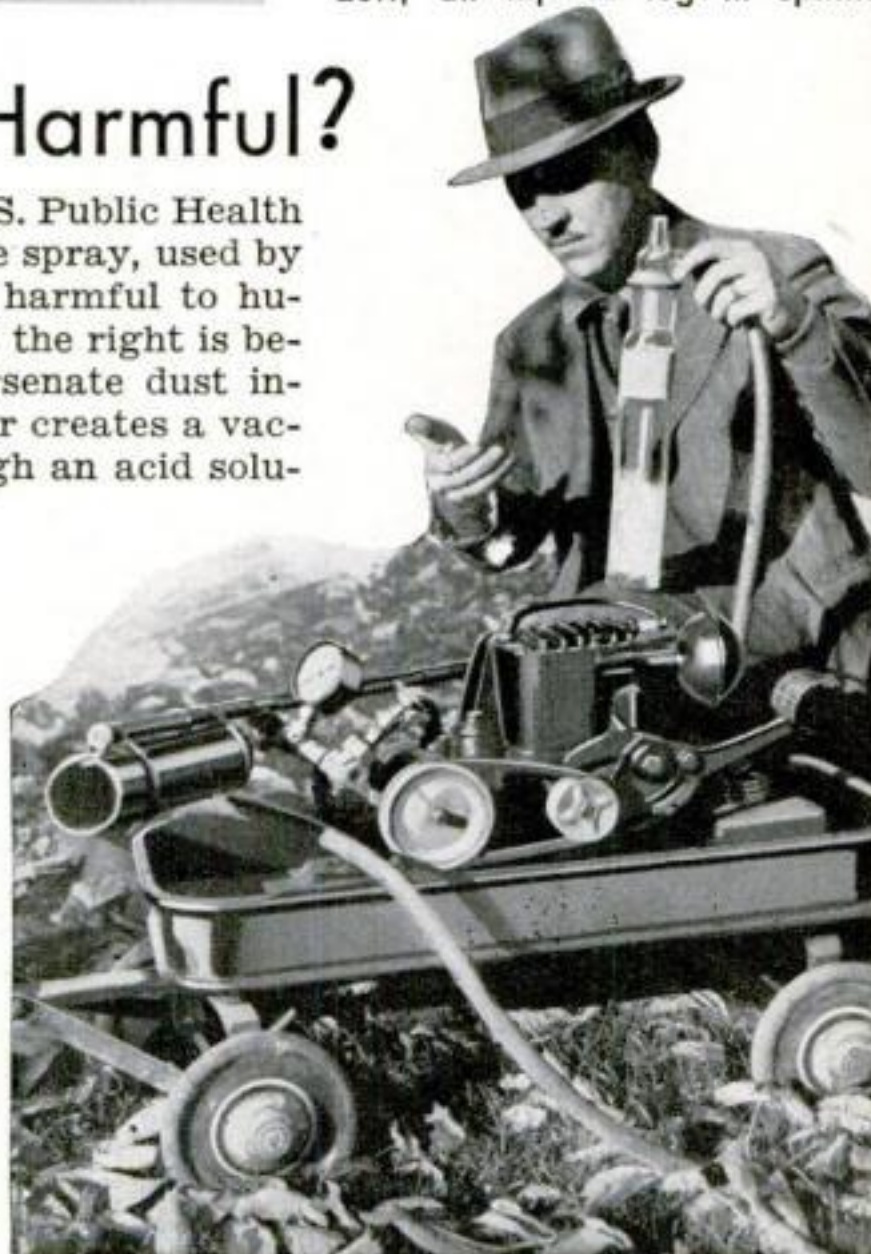
AS AN adjunct to their frog farm at Van Nuys, Calif., Claude C. Morgan and Lloyd B. King have established what is said to be the world's first frog hospital. The hospital offers treatments that range from amputation of injured limbs to rest cures for frogs "off their feed." Although frogs have practically no diseases, they do suffer an affliction called "red leg," which occurs when their naturally poor blood circulation is further weakened by an injury. Legs, therefore, are often amputated. No anesthetics are required, since frogs feel no appreciable pain.



"Sick bay" of the hospital where fretful frogs regain appetites. Left, an injured leg in splints

## Are Orchard Sprays Harmful?

PART of an extensive survey made by the U. S. Public Health Service to determine whether the lead-arsenate spray, used by growers of apples to combat insect pests, is harmful to humans, the wagonful of instruments pictured at the right is being used to determine the amount of lead-arsenate dust inhaled by workers in an orchard. A small motor creates a vacuum to drag a measured amount of air through an acid solution. The acid picks up the spray particles, and when the solution is distilled, the lead residue may be accurately measured.



Air sampler. It measures poison spray in orchard air

## Clamp Grips Truck Covers



ONE inch wide and weighing only two ounces, a new gripping clamp is designed to hold truck covers, heavy curtains, tarpaulins, and other heavy fabrics such as canvas. Adjustable to varying degrees of tightness, the device is said to hold up to 100 pounds.

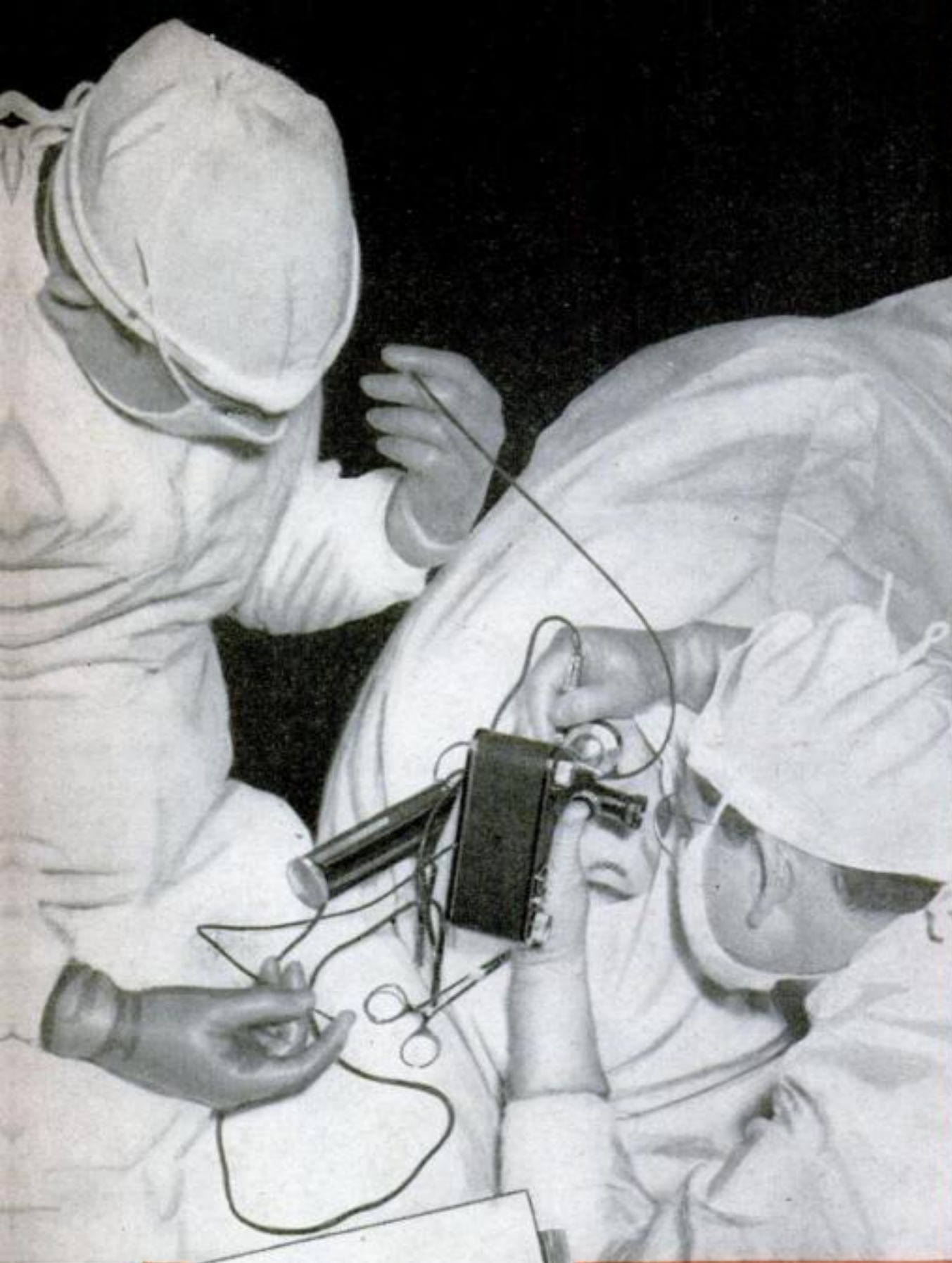


# PHOTOS

MADE BY

By  
**CHARLES  
BOWES**

A gastroscope fitted  
with a camera to take  
photographs of the  
inside of the stomach



With the long, flexible tube inserted through the patient's mouth into the stomach, the physician is viewing the "picture" through an eyepiece. Left, interior view of stomach; below, a photograph of the inside of the bladder





# INSIDE THE BODY

## PHYSICIAN-INVENTOR

**C**ANDID-CAMERA shots of the inside of the human body are being made with ingenious photographic equipment designed by Dr. Wayne M. Hull, Oklahoma City, Okla., physician and camera expert. By adapting miniature cameras to endoscopes, periscopelike optical instruments used for visual examination of internal organs, Dr. Hull obtains amazing pictures of the interiors of bronchial tubes, stomach cavities, lungs, and other hidden parts of the human anatomy. Providing an "inside" picture story, these photographs are proving of great value in aiding diagnosis of human ailments, and in providing permanent disease records for future study.

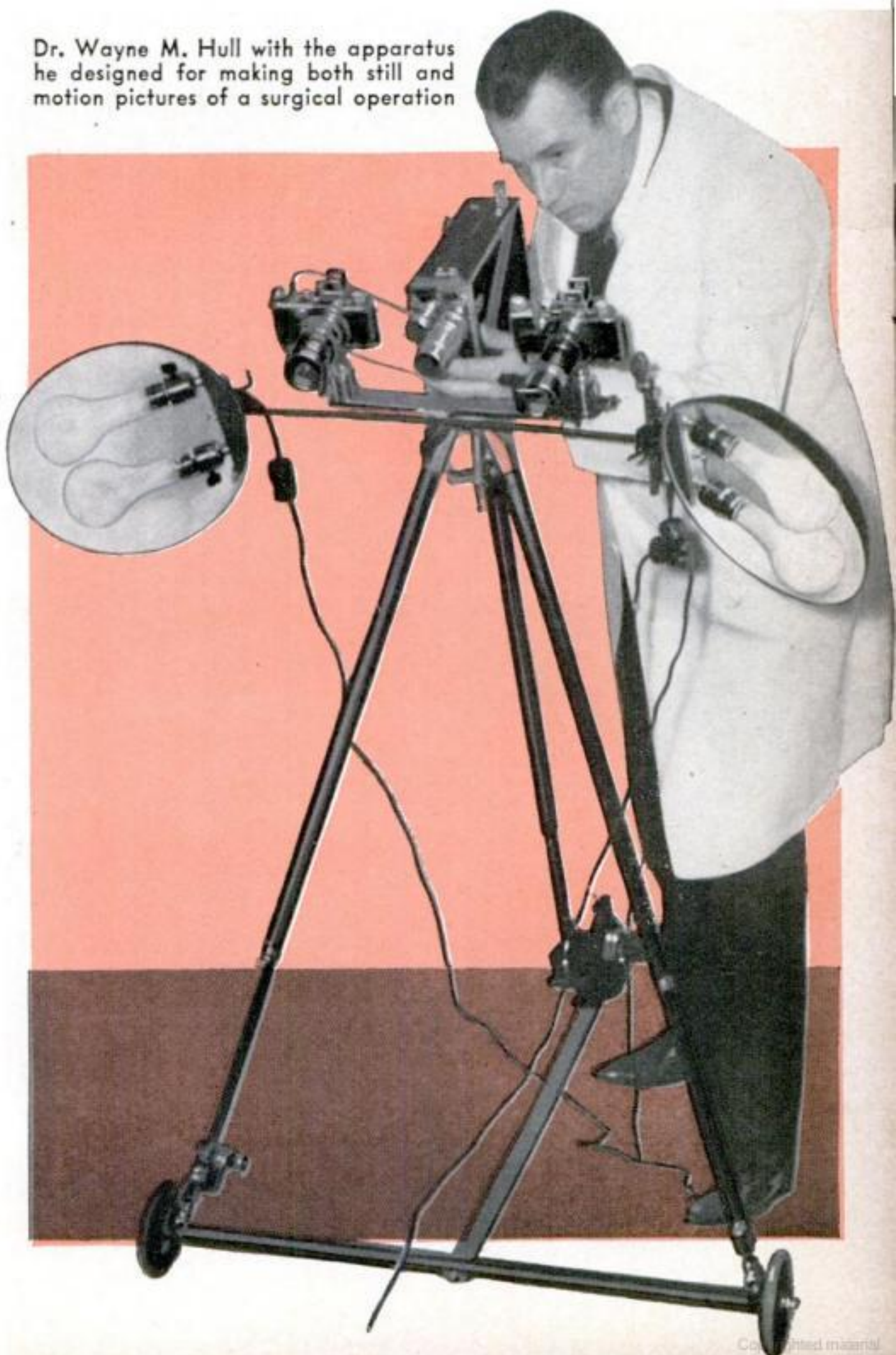
About four years ago, Dr. Hull purchased his first miniature camera and began to take pictures of interesting cases he met in his practice. Today, camera, exposure meter, photo-flood bulb, and various lenses and filters occupy a special compartment in his black medical bag, and form almost as important a part of his equipment as his fever thermometer, stethoscope, and medicine bottles.

Two years ago, he took up internal photography. First he fitted a microscope adapter to the eyepiece of an endoscope instrument. To make the camera light and easy to manipulate, he removed all the inner workings except the film-winding mechanism. Since the adapter itself, which fits on the front of the camera, contains a shutter, and is permanently focused on the lens of the endoscope eyepiece, the sole function of the camera box is to hold the film in place. Next he attached a prism to the

adapter so that he could look through a special eyepiece down the endoscope into the human organ being studied.

In a typical use of the equipment, on a patient complaining of a stomach ailment, for example, the physician first inserts a gastroscope, a slender, flexible endoscope with a battery-operated light at its lower end and designed to slip down the throat of a patient into his stomach. Through the spe-

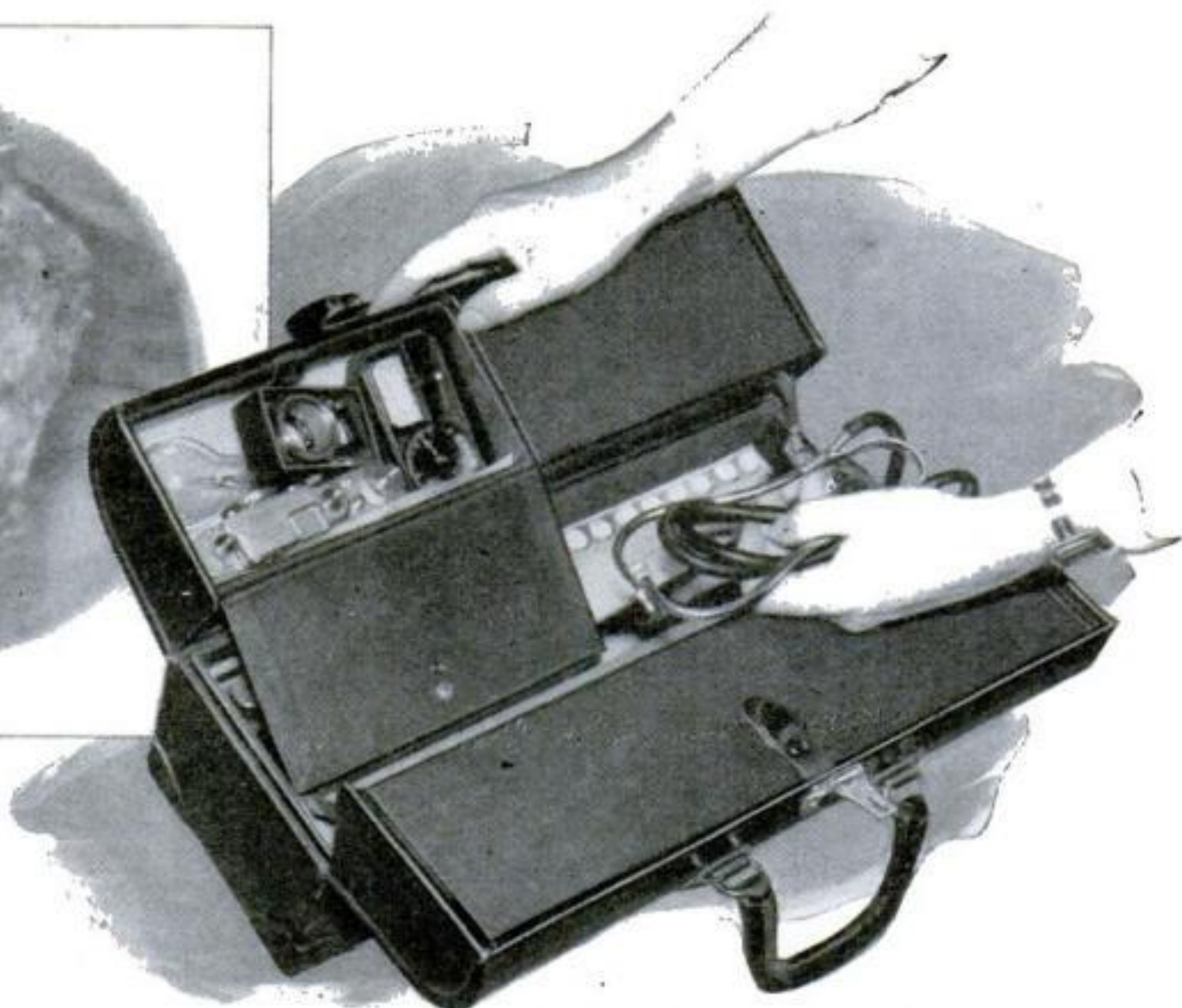
Dr. Wayne M. Hull with the apparatus he designed for making both still and motion pictures of a surgical operation







Miniature-camera equipment has an important place in Dr. Hull's medical bag. In circle is a photograph of a stone in a patient's bladder

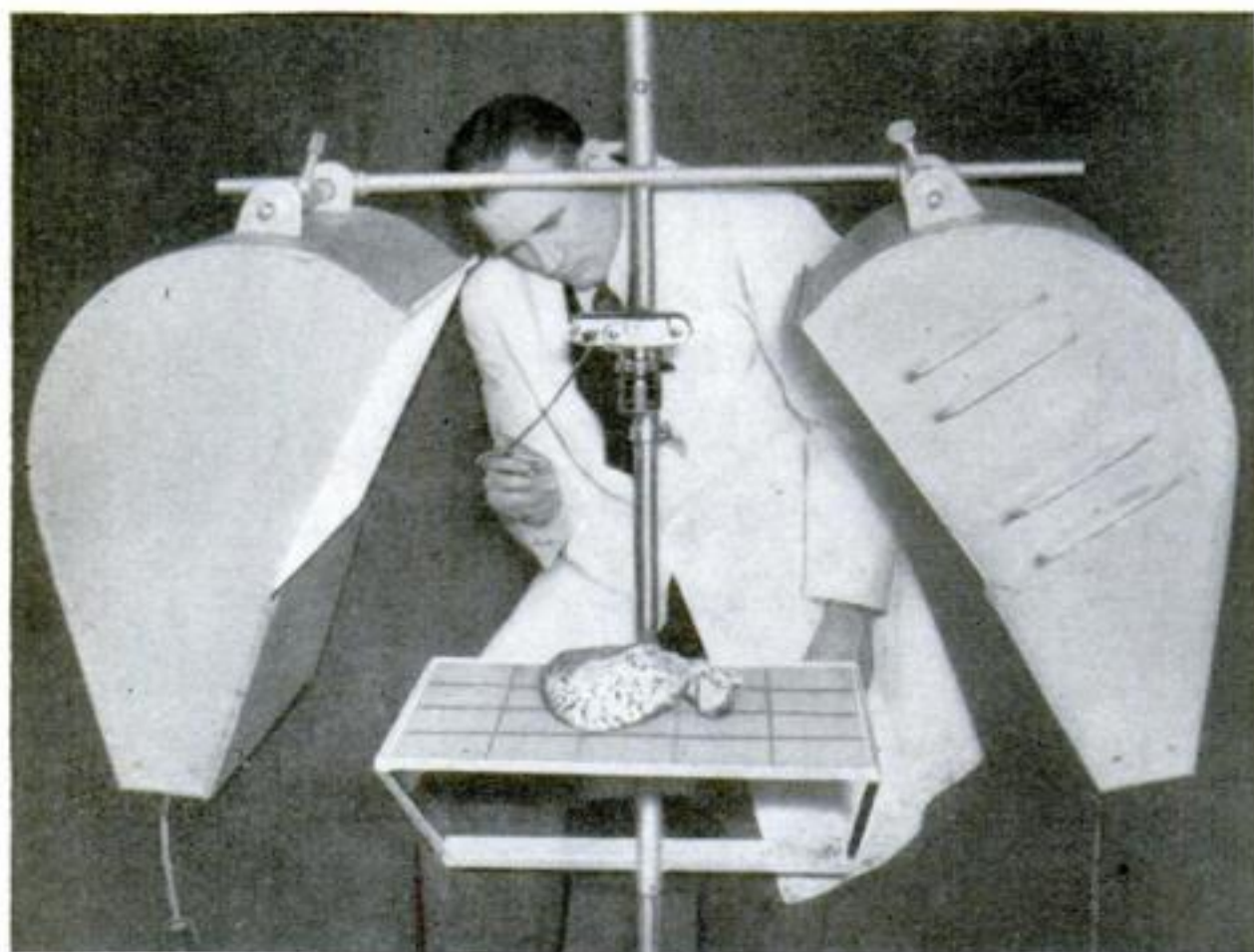


cial camera eyepiece the doctor studies the lighted interior of the stomach. If he finds anything abnormal which he desires to photograph, he turns the gastroscope so that the lens at its tip focuses on the spot. Then he presses one cable release which flips the viewing prism out of the way so that the full intensity of the light can go into the camera, presses a second cable release to snap the microscope-adapter shutter, and the photograph is made.

The same procedure is followed with bronchoscopes for examining the bronchial tubes, thorascopes for examining the lung cavity, and other endoscopic instruments now in general use. With the type of light bulb now employed with most endoscopes, pictures must be made on the fastest film available and with a full second exposure, making it necessary to snap the shutter between breaths of the patient. Dr. Hull believes that more powerful bulbs and even tiny flash

bulbs could be employed without danger to the patient, making shorter exposures and even color photographs possible.

In addition to this achievement in the field of medical photography, Dr. Hull has made two other important contributions: one, a system for taking photographs of medical specimens with great accuracy; the other, an ingenious rolling tripod arrangement of three cameras and two light reflectors, for taking simultaneous still and moving pictures of surgical operations both in black and white and in color. These novel outfits are illustrated here.



For photographing medical specimens, Dr. Hull devised this equipment. The ruled shelf indicates size, and hooded light reflectors eliminate shadows



# Static Operates Storm Detector

A STORM DETECTOR that lights a neon tube and rings chimes, as soon as the disturbance comes within 100 miles, now aids the guardians of New York City's power supply. Believed the only one of its kind, it has proved its worth after a year of trial by the Consolidated Edison Company.

When black storm clouds suddenly darken the sky, millions of New Yorkers in homes, offices, and factories turn on their electric lights. In the great power houses that supply them with electricity, additional turbines and generators must be cut in to meet the mounting load, as shown by squares lighting up on a big control panel. Since most modern generating sets require as long as two hours to warm up, operators of a power station need the ample storm warning that the new detector provides.

Its antenna picks up electric disturbances ac-

companying a storm, which broadcast listeners hear as static. A four-tube receiver amplifies the impulses enough to make a neon light flicker and energize a photo-electric cell, which, through a relay, operates the chime. As the storm approaches, the chime sounds at more and more frequent intervals, until finally, after serving its purpose, it is temporarily disconnected.



Lighted squares on the huge control board below show the power load

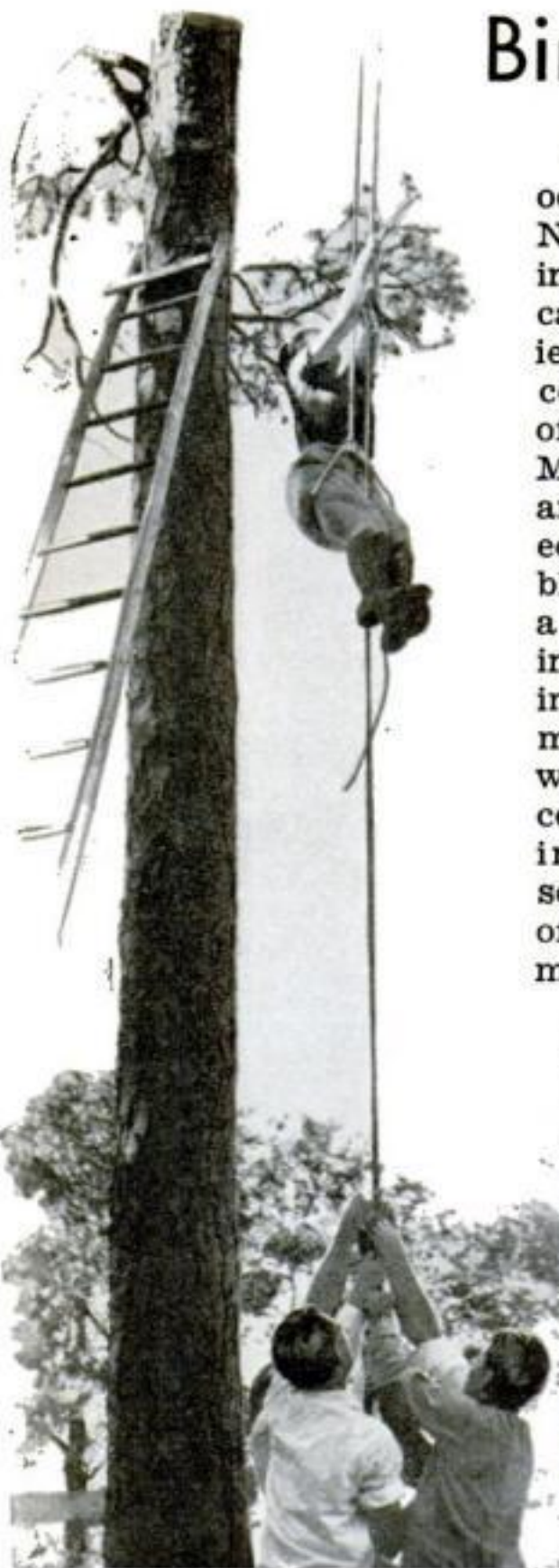
Storm-detector antenna. Static causes neon tube to light on panel below





# Bird Study Feathers Their Nest

THEIR common hobby of bird study has also proved a profitable occupation for two former school teachers, Juanita McComb of North Platte, Neb., and Hermione Vincent of Sublette, Ill. During the summer months they roam the country in a light truck, carrying equipment for camping out and for making color movies. Usually Miss Vincent is the photographer of the team, but Miss McComb, the younger and lighter, was hoisted ninety-five feet with block and tackle to film a mother eagle guarding its young. She also imitates bird calls, and makes paintings of birds with dyes and fluorescent paints. As traveling lecturers before school audiences the rest of the year, the pair make their hobby pay.



Juanita McComb goes aloft to take the picture of an eagle in its nest, reproduced in inset. At right, with her partner, Hermione Vincent, she loads equipment into their light truck



When not in use, the ax head folds into the handle

## Blade of New Camp Ax Folds into Handle

TURNING on a sturdy pivot, the head of a new camp ax folds neatly into a compartment in the handle, for convenience in carrying. In addition, the arrangement protects the keen edge of the blade, and lessens risk of injury when the tool is not in use. The ax has an accurate balance when adjusted for cutting, and a locking device holds the head securely in place.



# Penknife Modeler Carves a Castle

STANDING eleven feet eight inches high, a monumental model for a "castle of nations," constructed after ten years of labor by Frank T. Fitus, of Lawrence, N. Y., contains more than 50,000 separate pieces. Employing maple, birch, mahogany, and other woods, Fitus followed a number of different forms of architecture in his design, while a large number of the model's decorations are exact copies of art treasures housed in world-famous museums. More than 10,000 ornamental nails were used in the structure, whose carvings were executed with only a simple penknife. The castle is wired for lights. Fitus hopes that in some way his ambitious undertaking may be used to foster world peace.

Many styles of architecture in this novel model represent numerous lands. It was made of 50,000 pieces



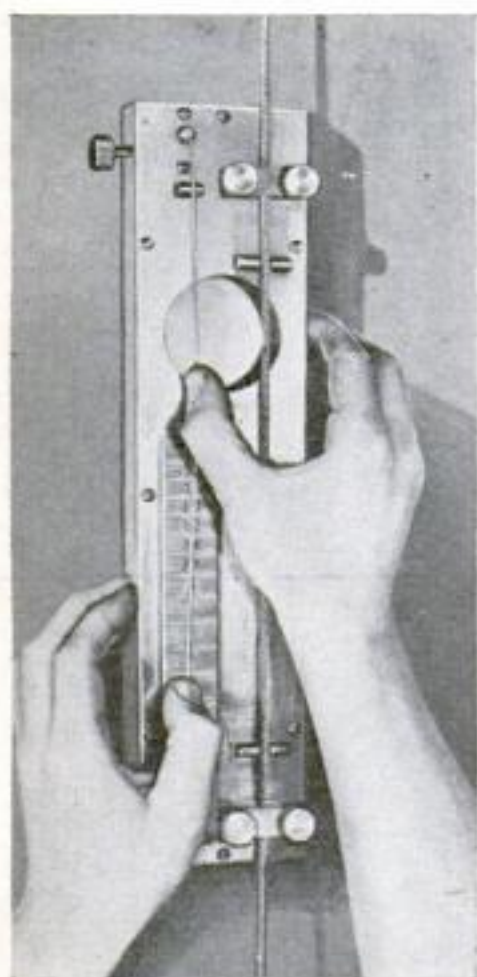


Glass-walled frames, radiating from a hollow column in which doors are cut, let the keeper watch his bees at work



## New Hive Shows Bees at Work

To study the work of bees, and especially the queen, in all parts of a hive, Lars Anderson, of Pittsburgh, Pa., constructed the odd sectional beehive pictured above. Eight glass-walled frames are fixed to a central axis so that the entire unit can be rotated. Each glass hive section opens on a central space around the axis to let bees pass from one frame to another.



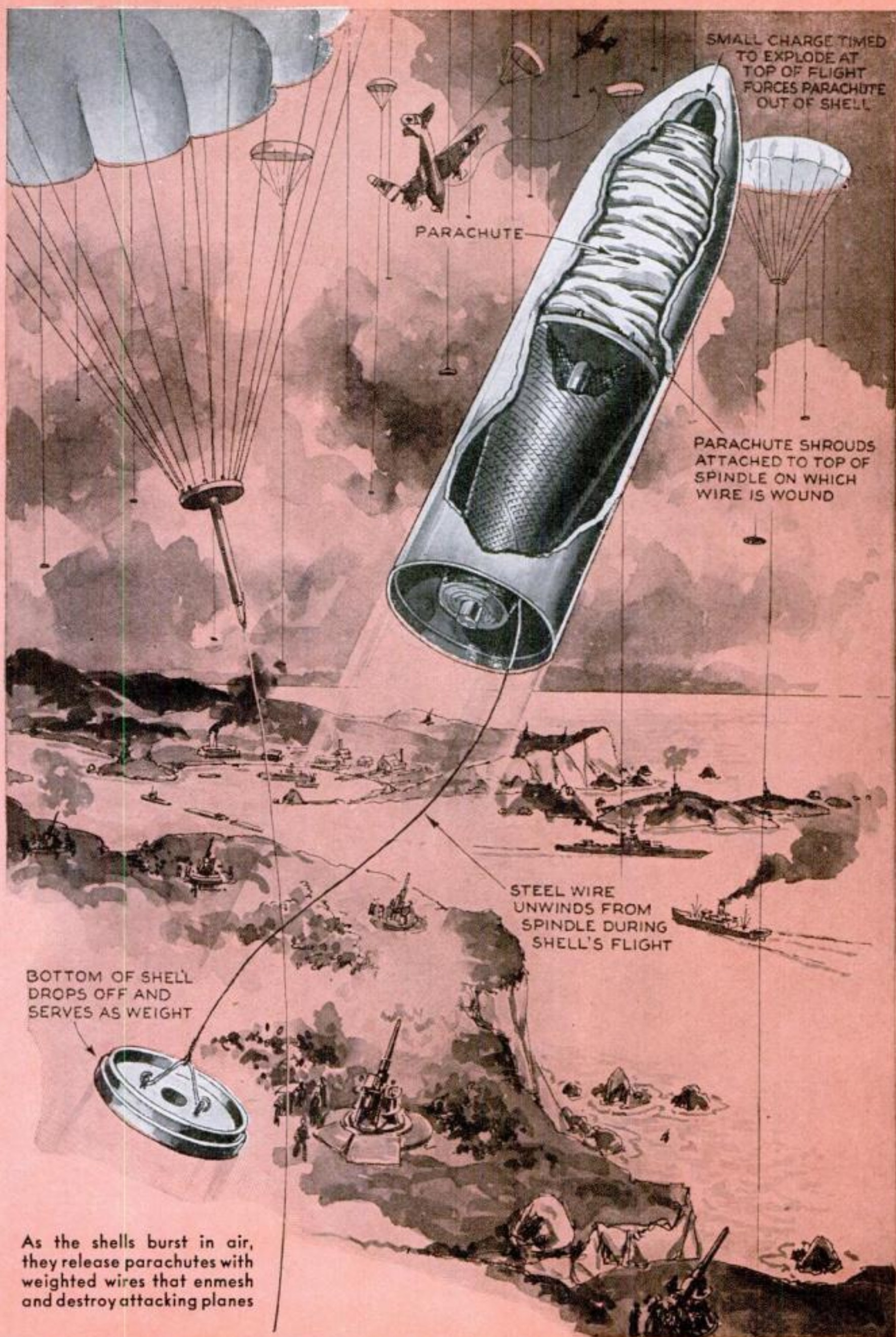
## Musical Meter Tells Tension of Wire Cable

TENSION of a wire cable is accurately determined by a novel musical meter recently developed. Useful for such purposes as tightening a wire stay on a sailboat to the proper tension, the instrument is provided with a pitch pipe to tune it. The musical note given off by the plucked wire under test can then be employed to measure its tension, just as tension of a mandolin string can be measured by plucking it.

# Parachutes Trap Enemy Bombers

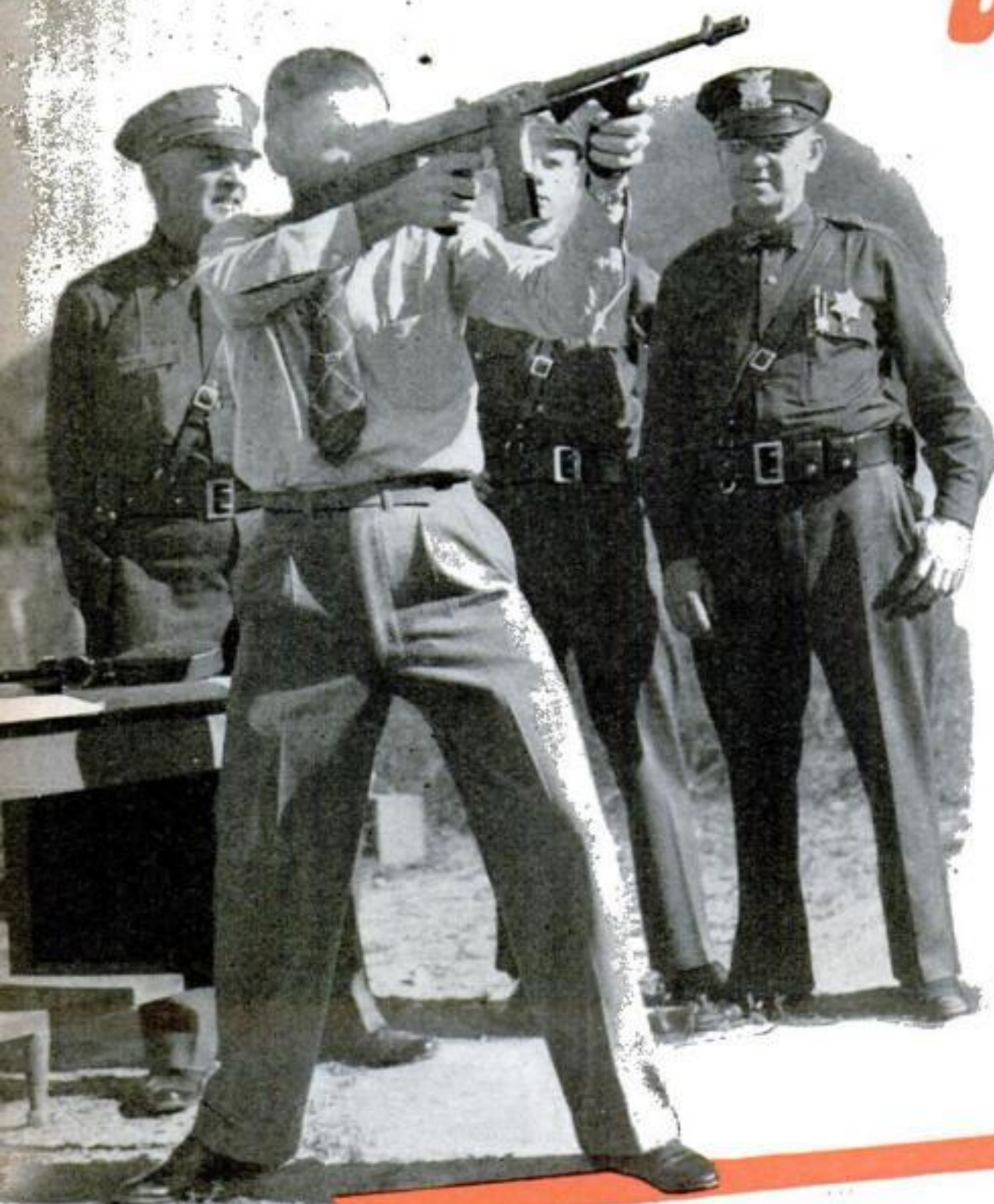
**S**HOT into the sky by anti-aircraft guns, scores of odd parachute shells burst open at various altitudes, releasing parachutes from which dangle long wires designed to foul the propellers and damage the wings of attacking enemy planes that run into them. That is the unique plan, devised by an anonymous American inventor, which the French Army is said to be considering as a means of defense against air raids on vital points. Like an elaborate Fourth-of-July rocket, the shell would be fired up into the sky. Its whirling movement automatically unscrews its weighted base, which drops out, dragging with it a wire cable that unreels from a spindle in the shell. At a desired height, a time fuse explodes a charge that forces out a parachute packed in the shell nose. The extended steel wire, weighted at the bottom, then drifts slowly earthward. With hundreds of these cables dangling dangerously down from the sky, attacking planes would find it practically impossible to avoid fouling against one or more of them, the inventor claims. A wall of these down-drifting cables, military authorities are said to believe, would constitute a much stronger defense against attack from the air than the elaborate and costly "balloon barrage" which the English defense forces employ to protect the city of London (P.S.M., Aug. '38, p. 27).







# Western



**Y**EARS ago, when a sheriff of the old West went into action, it was usually after the crime was committed. Learning of a robbery or a shooting, he traditionally sprang on his pony and galloped off into the sagebrush to track down his man. Sometimes he brought him back, if he wasn't shot in the attempt.

Today, modern deputy sheriffs of Los Angeles County, riding in high-powered cars equipped with two-way radios, use a different technique. Let's say one of the network of closely organized operatives spots suspicious characters entering a restaurant. Station KQBY, central 500-watt transmitter for the system, flashes warning across the air to cruising radio cars. Talking with each other as they close in, officers in three of the cars plan a

Proper technique for handling the Tommy gun, above. It spews 800 shots a minute. Shooting tear-gas guns at dummy targets is essential training

By  
**ANDREW  
R.  
BOONE**





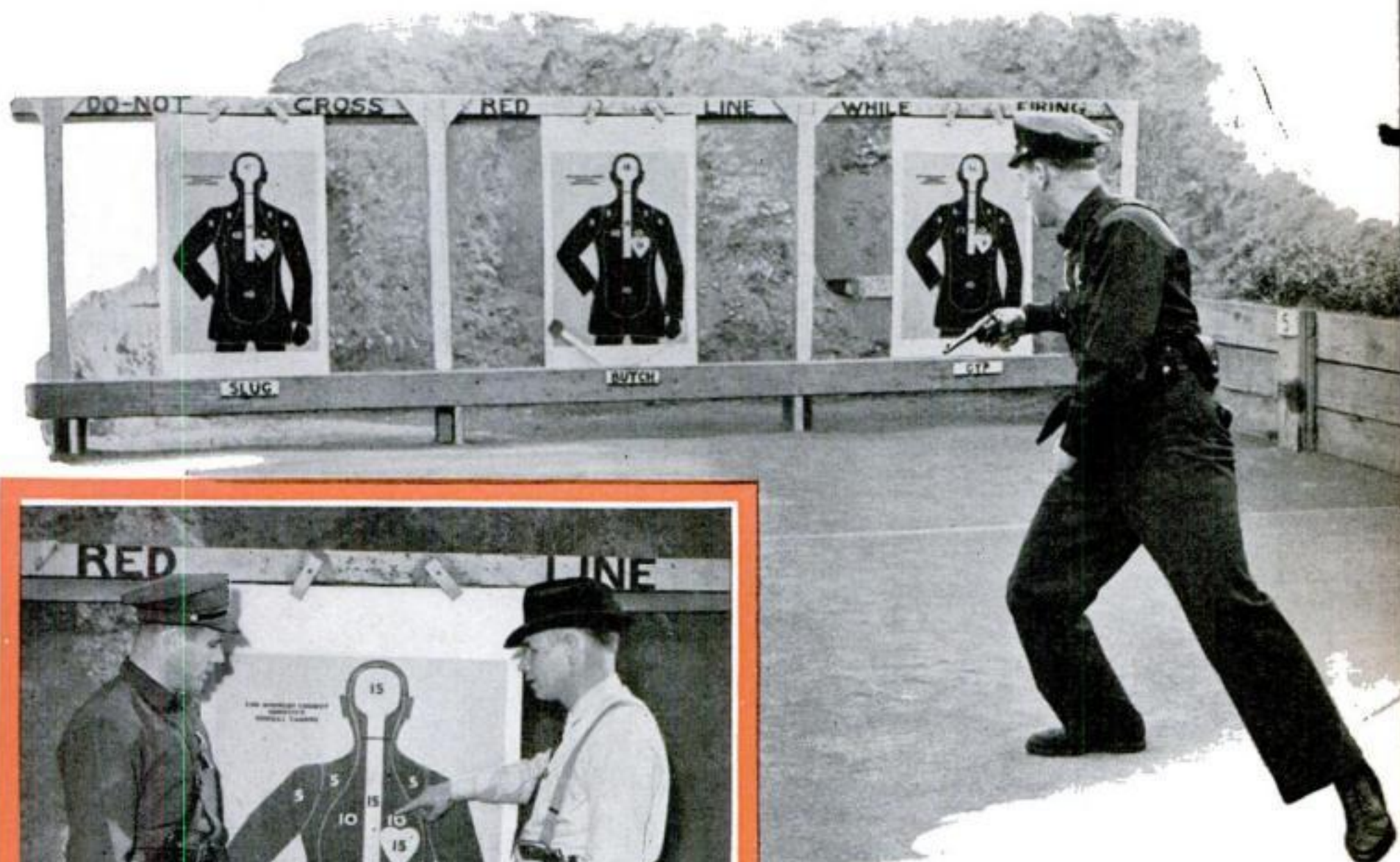
# Sheriffs Go Streamline

blockade of the place. Posting guards at side doors and alleys, the others burst into the restaurant with guns drawn. Three armed desperadoes stare blankly into the muzzles of revolvers and give themselves up without firing a shot. Later they admit to a half-dozen hold-ups and confess that they were about to stage another—a crime that never came off.

How different from the methods of backwoods sheriffs. Billy the Kid and other desperadoes of the lawless frontier would rub their eyes in amazement to witness the cold dispatch and speed with which western sheriffs get their men today. Besides two-way radios and high-powered broadcasting sta-

tions, machine guns, gas guns, hand grenades, and parachute flares are their weapons. As for the modern deputy sheriff himself, his trigger finger "squeezes the lemon" with speed and deadly accuracy unapproached by bad men of the old West.

These crime-wreckers learn to sling lead with scientific accuracy long before they come to grips with safe crackers, stick-up artists, car thieves, and murderers. Like professional soldiers, they train for combat. They can beat the most experienced trigger man at his own game, and plug him through the head, spine, or heart before his



Los Angeles, Calif., deputy sheriff in "combat" practice advances on targets dubbed with underworld names. Close-up, left, shows man's most vulnerable spots





nervous trigger finger can fire a revolver.

Nine tenths of all the gun battles fought by officers are anticipated on the gun range under the direction of Sheriff Eugene Bis-

cailuz, in a ravine near Los Angeles. Here his own and visiting officers, facing "Slug," "Butch" and "Gyp," three make-believe "criminals" painted on targets, practice quick-drawing and firing from "hands-up" postures. They never know when a whistle will sound, signaling for the firing. They never know over which target a red circle will flash ordering firing to start at that point. But they aim for the heart as their bullets rake all three targets, and they save

From this radio mast and the directional antenna, signals streak out to the patrol cars manned by streamline sheriffs



Sitting at his microphone, a dispatcher shifts cars around the county like chessmen. Each car carries a sturdy, two-way radio like that above





a bullet for the head of the one first attacked.

Sgt. Tom Fleming makes experts of these men. "They're good, too," he assured me. And they have to be. For each year 1,100 of these experts answer 80,000 radio calls, and they never know when they may walk into a potential death trap.

In plain clothes and uniform, deputies on various details finger their weapons knowing they stand better than an even chance to get their men. Many have adopted a special open-face holster and revolvers with four-inch barrels. Hammer spurs have been cut off, and trigger guards opened in front to facilitate reaching the trigger.

"Our boys," explained Fleming, "are not conscious of reaching and drawing their guns. It becomes a simple operation. They're ready for action without fumbling."

Deputies trained under this veteran must learn to be steady until the opportune moment, then go into action like a whirlwind. And they must always advance upon a criminal, never back away, for advancing makes the wanted man a larger target. On the combat range I saw Deputy E. G. Jones "mow down" the targets with amazing accuracy.

Jones stood first with hands raised. A wigwag signal stood erect in front of "Slug." "That means

Jones is covered by a gun," explained Fleming. Suddenly the signal dropped. Quickly, Jones drew his gun and put one shot into each target. One in the heart, another in the spine, the third in the solar plexus. Elapsed time: 1.3 seconds.

Again, Jones ran through his combat-firing practice. From fifteen back to thirty feet, hands up, walking in and away, usually blasting the paper figures in the spine or heart as the signal would drop. And only one miss in thirty shots. "Don't ever draw a gun on one of these boys," said Fleming.

Not long ago, one of Fleming's "boys" walked into a small riot. Without awaiting help, he waded in and tried to stop the rough stuff. Several tough customers got him down and were kicking him senseless when he drew his revolver and with a single shot killed the ringleader. That's what Fleming meant when he warned against any monkey business with these straight shooters.

No matter where they go, in desert or mountains, the magic of radio keeps deputies riding dusty roads far from the city always close to head- *(Continued on page 231)*

Sgt. Tom Fleming, right, demonstrates the "combat draw," advancing as he removes his gun. He has taught 1,100 men to shoot straight and fast, using special holsters, and guns with cut-away trigger guards that let the forefinger drop upon the trigger instantly



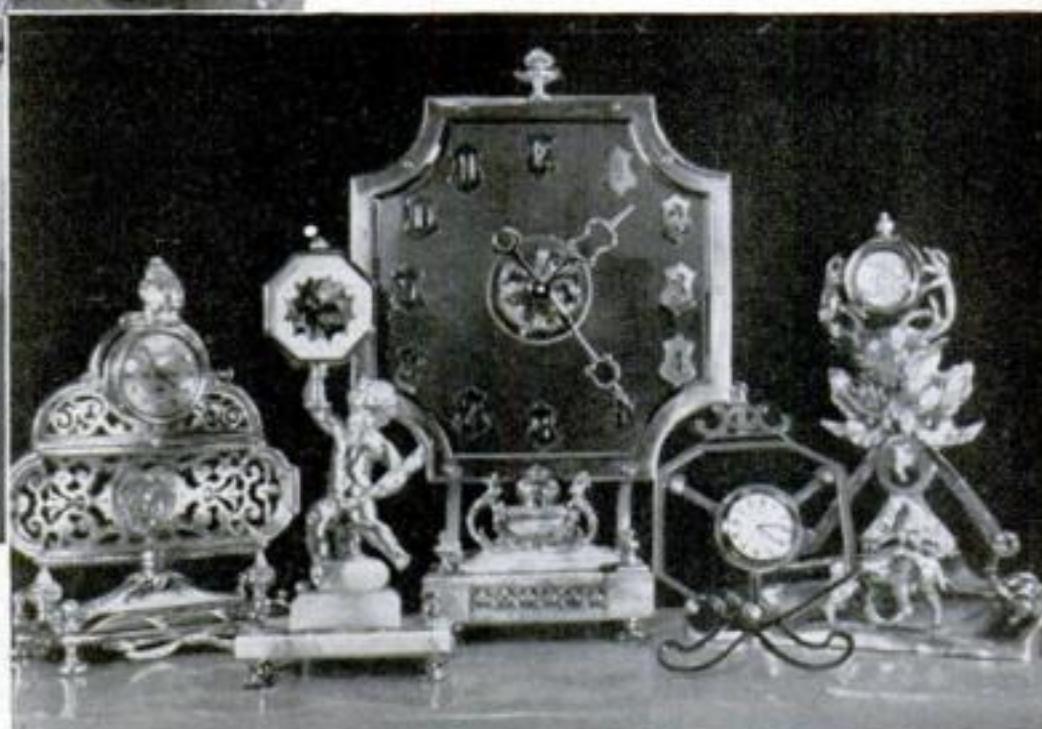


# Artistic Clock Cases Made from Junk



REMountING old clocks in decorative and artistic cases that are made entirely from junk materials is the unusual work of J. Edelstein, a New York City artisan. Working in the basement of his home, Edelstein uses only simple tools, scrap brass purchased from hardware stores, and various ornaments and odds and ends picked up in junk shops. When the clock settings are completed, they are turned over to a plating expert who plates all exposed metal surfaces with gold.

J. Edelstein at work turning scrap material into decorative clock cases. Some of his remarkable creations are shown in the photograph at the right

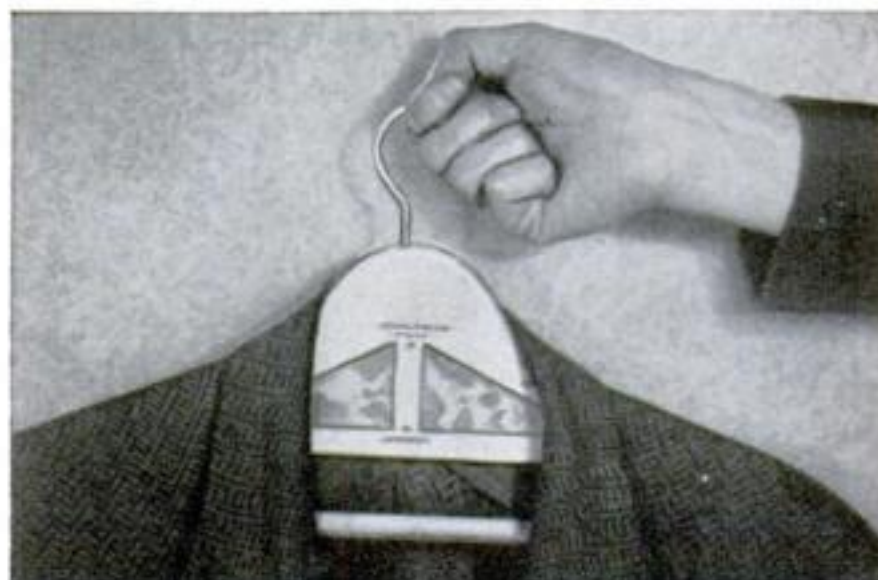


## Hollow Handle of Toothbrush Holds Powder

TOOTH POWDER can be stored in the hollow handle of a novel toothbrush just marketed. In use, a cap at the end of the handle is flipped up, allowing the powder to be poured into the palm of the hand, where it is scraped up onto the brush bristles. When the brush is worn out, it can be unscrewed from the handle and replaced.

## Fumigant in Coat Hanger Keeps the Moths Away

A COAT HANGER that automatically moth-proofs clothes that are draped on it is now available. Built into the hanger, which is made of a white wood, is a chemical fumigant that gives off fumes designed to discourage the activity of moths in the area. The fumigant is supplied in cake form.



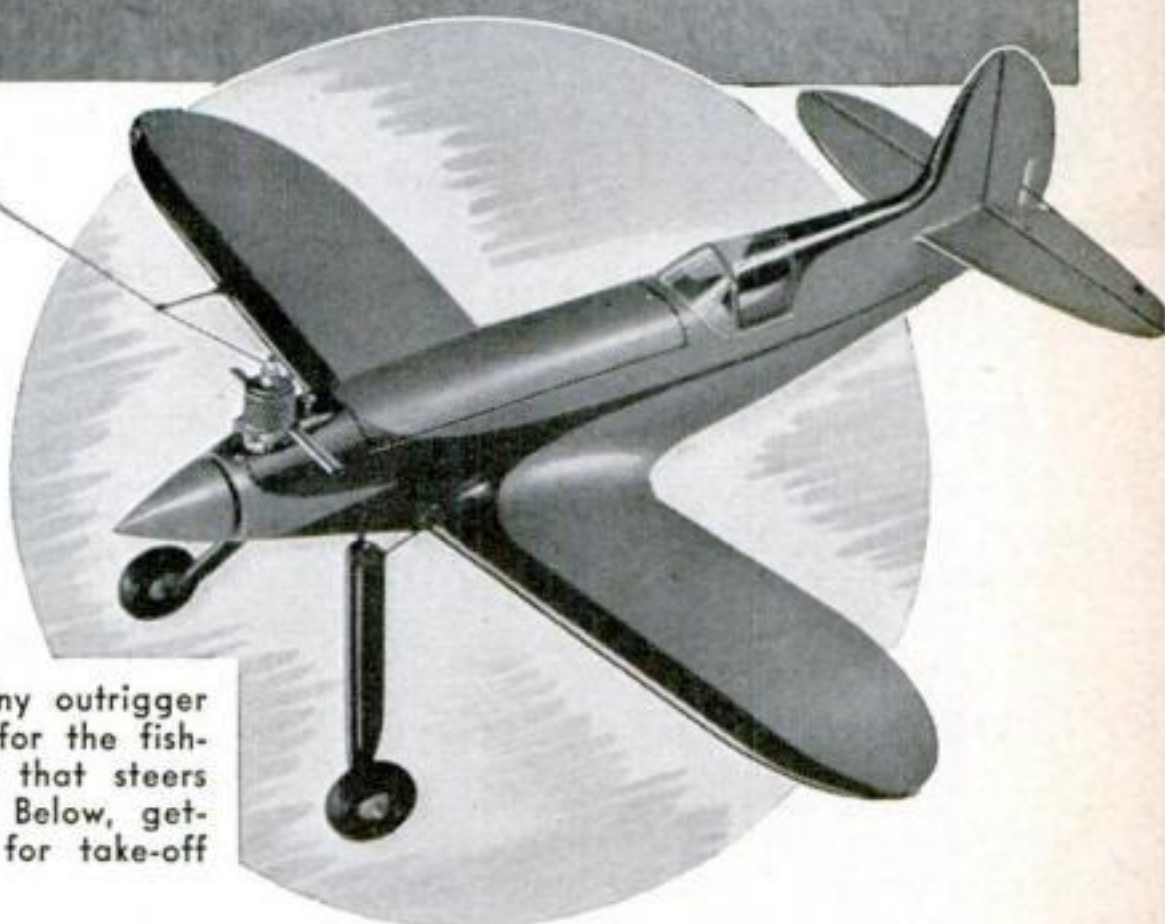
Moths stay away from a garment put on this hanger





Circling at seventy-five miles an hour, the gas-powered plane is controlled from the ground

## Pole and Line Control Tiny Model Plane



Notice tiny outrigger on wing for the fish-pole line that steers the ship. Below, getting set for take-off



**F**LYING at speeds up to seventy-five miles an hour, a new streamline model airplane is under full control of its operator on the ground, who puts the ship through dives, zooms, and other maneuvers with a novel guide-line system for which a patent application has been made. Propelled by a one-fifth-horsepower motor, the sleek ship is controlled in the air by means of a fifty-foot silk or linen line, attached at one end through a projecting control arm to a wing of the plane, and at the other to the tip of a pole resembling a fishing rod, held by the plane's operator on the ground. According to the manufacturer, it is the location of the point of attachment of the guide line to the plane wing that gives the ship its inherent stability and permits it to be maneuvered, as it circles in mid-air, by simple up-and-down movements of the pole. At the end of a flight, the tiny ship comes in to a smooth, graceful landing.



# New Ideas

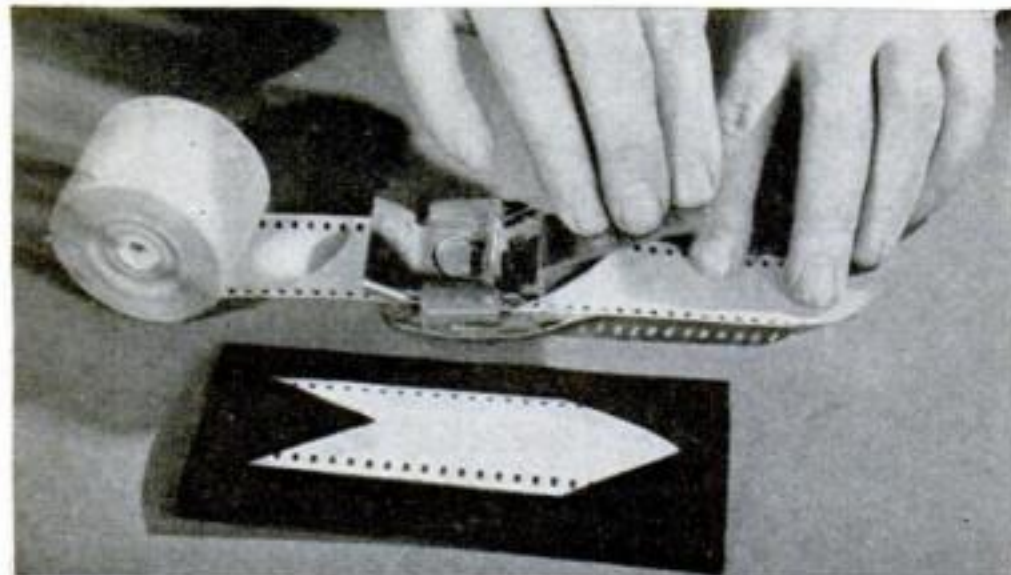


## Case Mounted on Tripod Leg

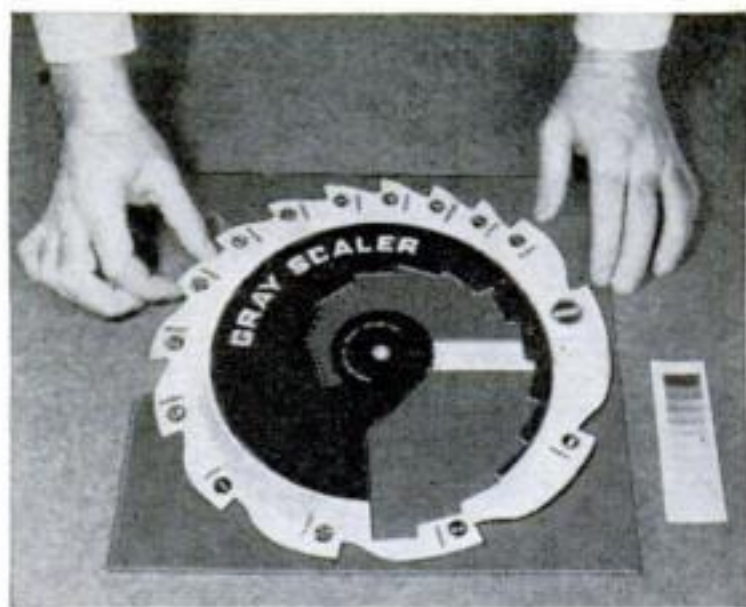
A NEW tripod case that remains attached to one leg of a tripod while the tripod is in use is now available. The leather case has a full-length slide fastener to facilitate opening and closing.

## Speedy Bulk-Film Trimmer

CUTTING a tongue on 35-millimeter bulk film to facilitate loading it in a cartridge is accomplished quickly with the cutting tool shown in use below. The cutter is provided with its own guide track to center the film properly under the cutting edges, even when used in total darkness. After the film is in place, only a slight pressure on a convenient lever is needed to cut the film.

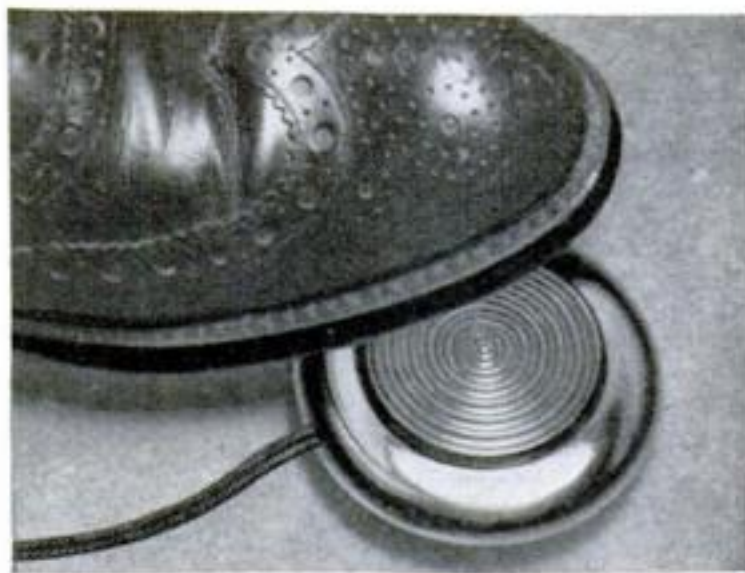


This cutter puts a pointed tongue on film for easy loading



## Card Tests Paper's Range of Tones

GRADING test strips of printing papers is easy with the device illustrated above. A test strip is placed under the opening shown at the right of center of the unit. Notches on a moveable disk are then advanced one by one as exposures under an enlarger are timed according to the number of seconds marked on each notch. The developed test strip then shows the gray-scale range of the paper.



## Darkroom Foot Switch Is Easy to Operate

SHAPED like a flattened-out rubber ball, a novel foot switch for enlargers or other darkroom electrical apparatus can be kicked all over the floor and still come to rest ready for use. The same on top and bottom, it operates at a touch of the toe regardless of which of its two flattened surfaces happens to be uppermost.



# for Photography Fans

## Films "Developed in Air"

EXPOSED films are "developed in the air" with a developer just announced. After soaking in the solution for five minutes, films are removed from the developer and exposed, in darkness, to the air for from twenty-five to thirty minutes. According to the manufacturer, development takes place during the latter period only, and only to the extent necessary for perfect development, even in cases of considerable under or overexposure of negatives.



Demonstrating how films are hung up to develop in the air

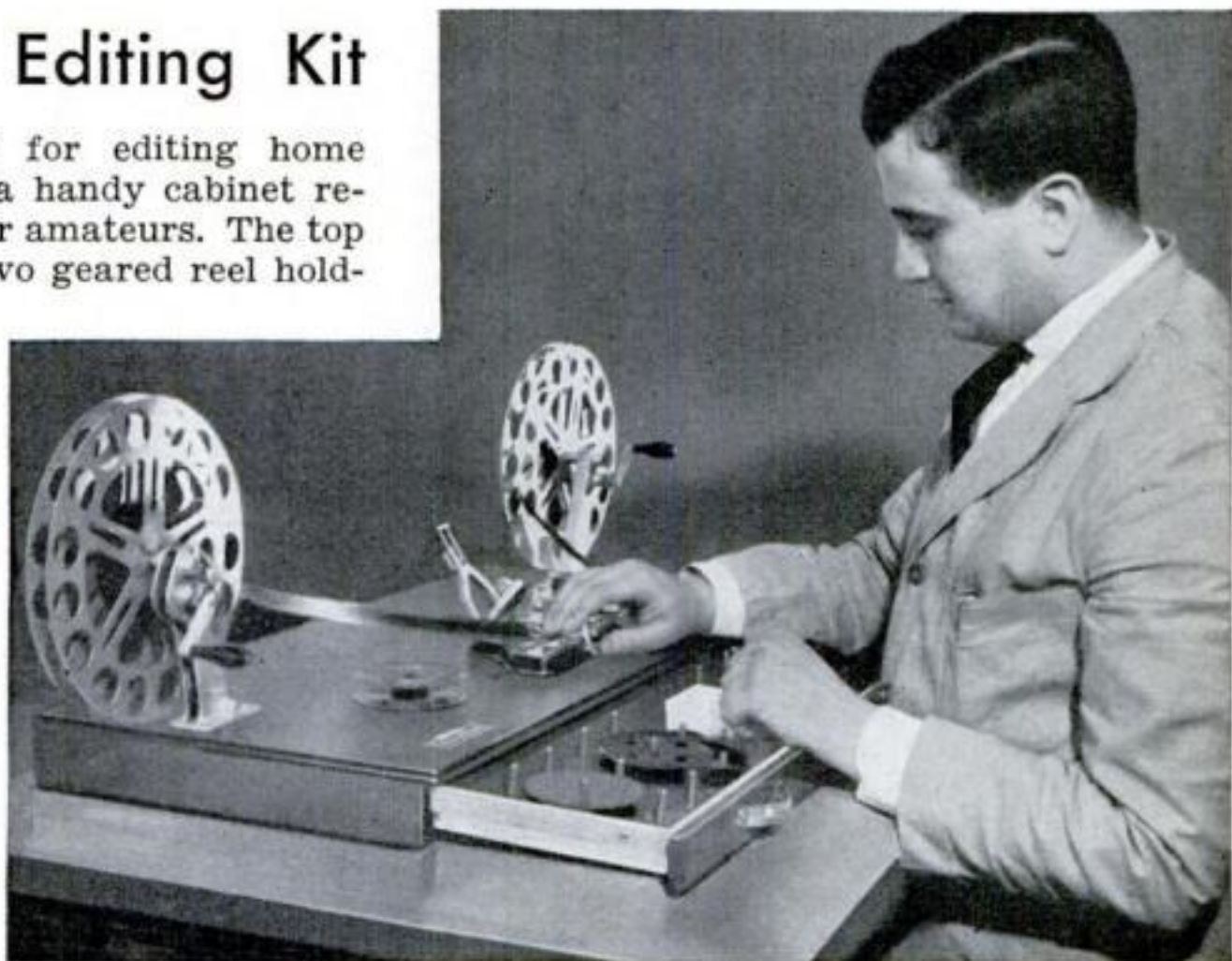


## New Fade-Out Unit

TRIPPED by means of a cable release, a spring-operated unit that attaches firmly over the lens of a moving-picture camera can be adjusted to give as many as sixty-four different fade-out effects. A set of five optical-glass filters in a special kit is also available for use with the device.

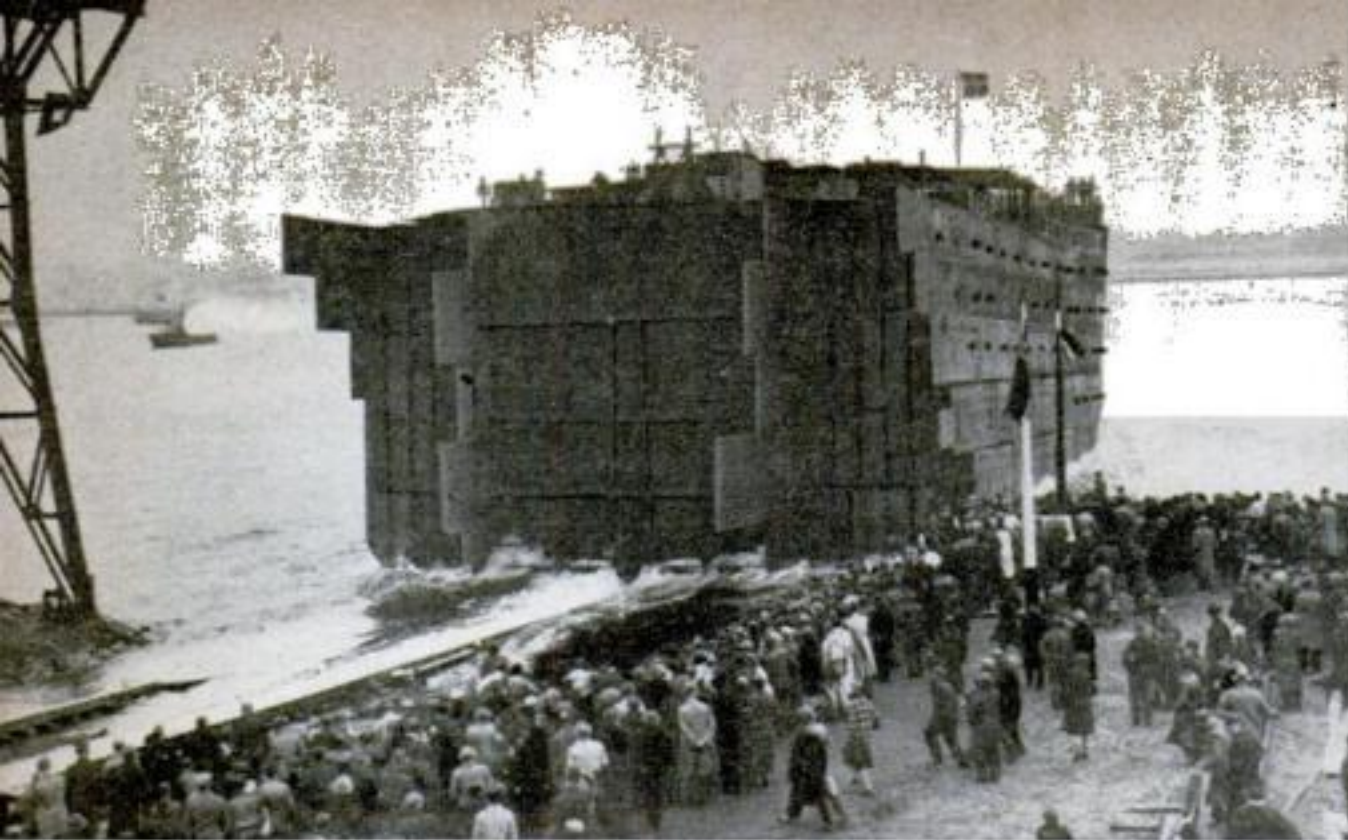
## Home-Movie Editing Kit

COMPLETE equipment for editing home movies is contained in a handy cabinet recently made available for amateurs. The top of the cabinet carries two geared reel holders which provide for winding and rewinding films. A splicing apparatus complete with film cutter is placed near the front of the top panel, while a drawer within is equipped with wooden pegs for holding spools of film during editing operations. Film cement and a pad for notes are included in the outfit, which can be conveniently carried from one place to another.



The kit includes all equipment needed for cutting and splicing movie films





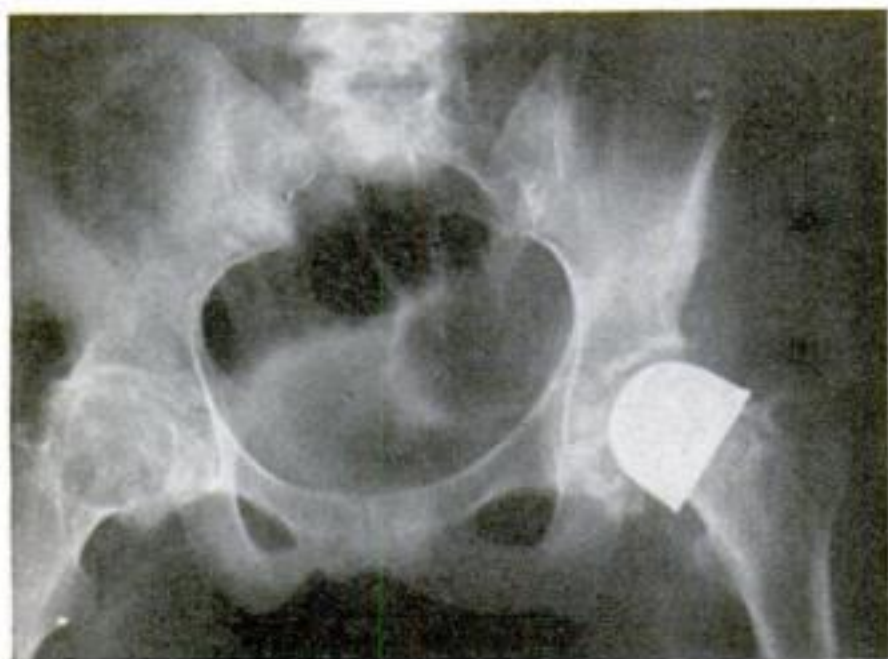
Launching a new forward section built for a damaged Norwegian tanker. Below, it is about to join the salvaged stern

## Half Ships Built To Replace Part Lost in a Storm

HALF a ship slid down the ways recently in a novel launching at a shipyard in Amsterdam, The Netherlands. This unusual event was necessitated after a heavy storm at sea split the Norwegian oil tanker *Jaguar* into two pieces. Only the aft section was saved, the fore part settling to the bottom of the ocean. In port, a new fore section was con-



structed and launched, and then joined to the old salvaged aft section, as shown in the photographs reproduced above. Note the Norwegian flag proudly flying from the curious half ship as she slides down the ways.

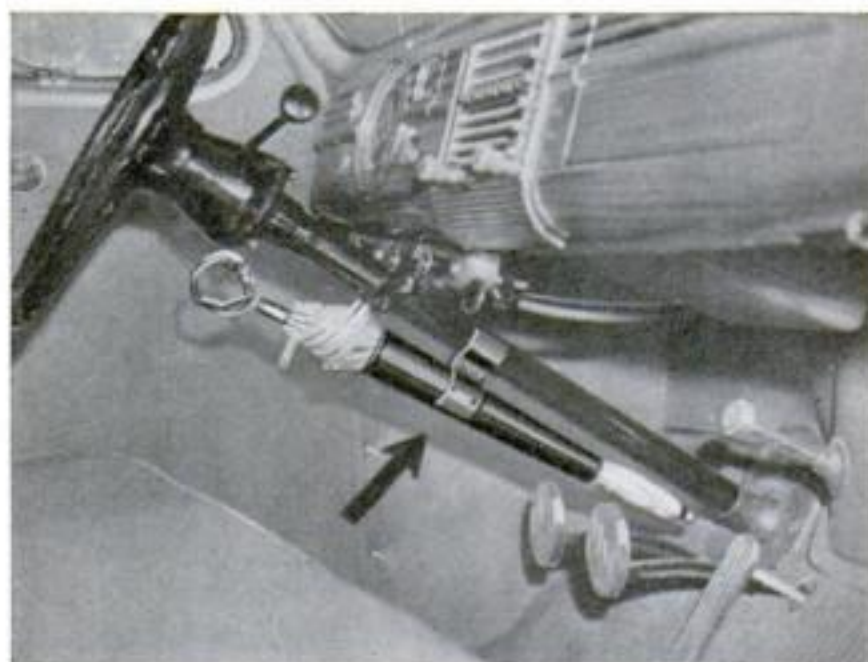


## Artificial Hip Sockets

INSERTION of artificial hip sockets made of metal is a surgical feat recently reported to have given a young Kansas City, Mo., victim of arthritis a chance to regain the use of her limbs. The white object visible at the right and just below the center of the X-ray photograph reproduced above, is one of the metal hip sockets. A similar socket has since been inserted in the other hip.

## Cars Get Umbrella Holder

AN UMBRELLA can be held in a handy and convenient position within an automobile by a new holder that clamps the rain shedder to the underside of the steering column. Easily and quickly installed, the device holds umbrellas of all standard sizes and does not interfere with the new steering-column type of gearshift on late-model cars.



The holder fits underneath the steering column



## Eight-Foot Model Plane Boasts Three Motors

Side view of the amphibian reveals its novel design. Special pontoons fit beneath the wings. Below, the tri-motored plane and its young designer-builder

**S**EVEN and a half feet long, and with a wing spread of eight feet, a model airplane constructed by eighteen-year-old Walter Benjamin, of New York City, is shown in the accompanying photographs. Powered by three quarter-horsepower gasoline motors, one in the nose and two in the wings, the model amphibian is equipped with special aileron flaps that prevent the craft from banking or turning too sharply for safety. Special wing fittings allow pontoons to be attached.



How the hoist lifts one end of car to simplify repairs and greasing

## Portable Hoist Lifts End of Car

OPERATED by air pressure, a portable one-end lift for automobiles has just been developed. Placed under either the front or rear axle of a car, the device will raise the end to a height of five feet, making it easy for mechanics to do repair work on the underside of the vehicle. The lift is mounted on a wheeled base so that it can be rolled from place to place. A shelf that is built into the unit holds the tools and spare parts needed for a job.



# New Appliances

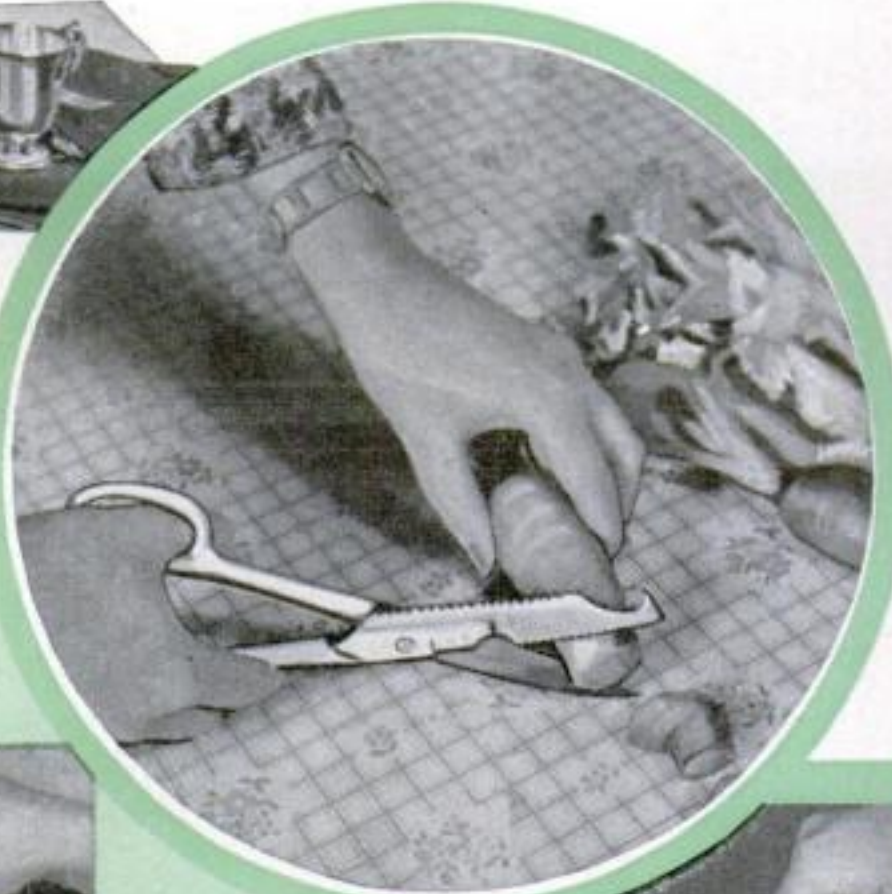


**SILVER CLOTH.** Silver does not tarnish if wrapped in a new cloth impregnated with tiny silver particles that absorb tarnishing agents



**POT HOLDER.** Made of a special rubber that is nonabsorbent and heat-insulating, this tube-shaped holder is slipped over the handle before a pot is placed on the stove

**MEAT BASTER.** Basting meat is easy with the device below. Squeezing and releasing bulb draws liquid up into the metal tube, from which it is easily squirted on the roast



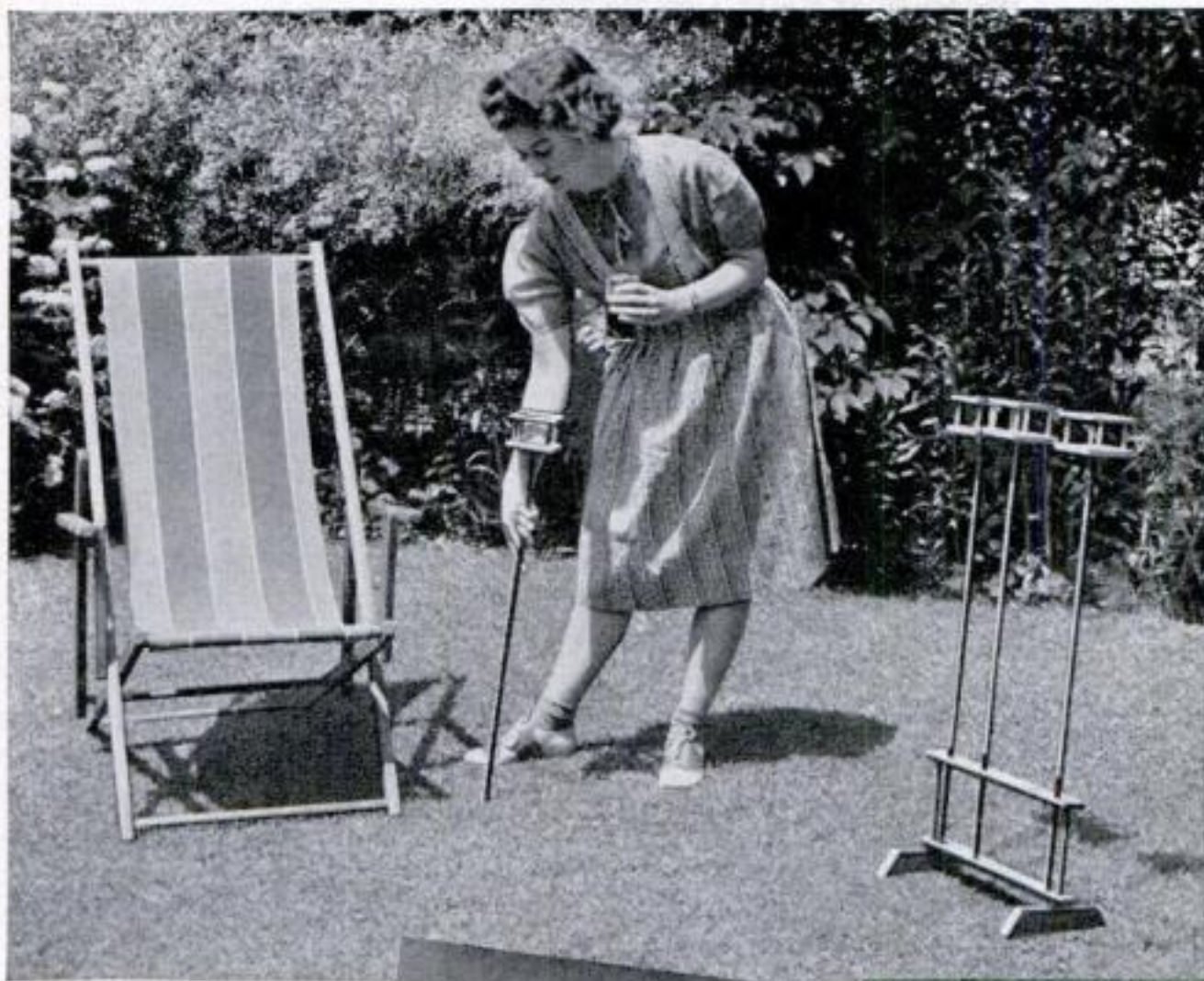
## HANDY SHEARS

These novel shears come apart easily for cleaning, and to permit the use of various tools on the blades, including vegetable scraper, bone cutter, fish scaler, and bottle opener (shown at right)





# for the Household



## DRINK HOLDERS

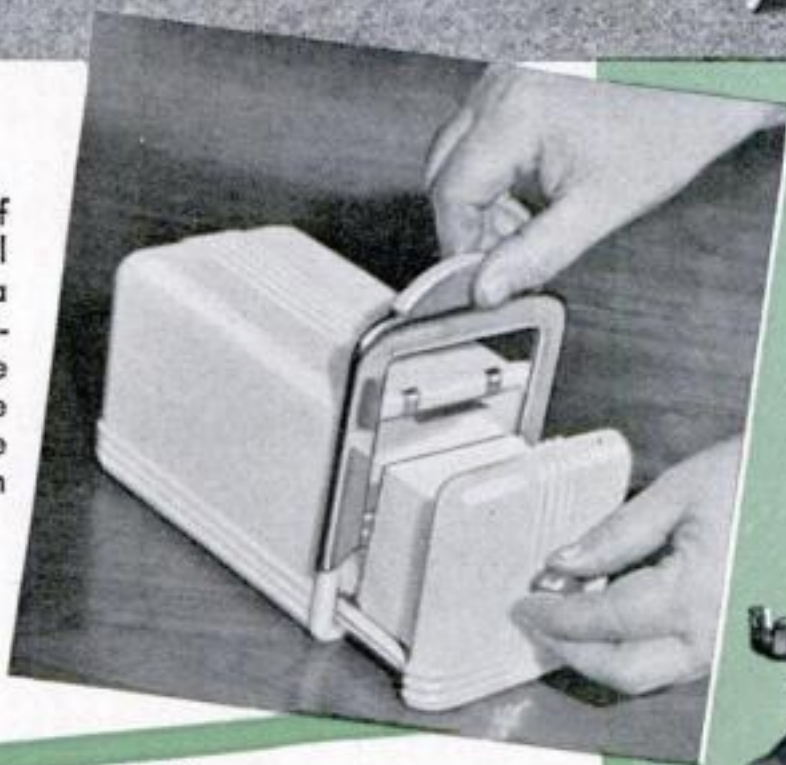
Stuck in the ground, these novel holders solve the problem of where to put glasses when serving drinks outdoors. A storage rack goes with them

## TELEPHONE STAND

A handy place for the phone is the stand below. Resembling an ash stand, it has a substantial base and a rim to hold the phone

## BUTTER SERVER

Holding a pound of butter, this novel container fits in a refrigerator. Uniform slices can be measured by a scale and cut off with the sliding knife shown



## NEW SQUEEZER

For small amounts of lemon and lime juice, the tool at left squeezes quarters of the fruit. Pressure keeps the pulp and seeds out of the receptacle





# POPULAR SCIENCE

## Question Bee

How's your scientific I.Q. today? Get nineteen of these posers right and consider it mighty good; twenty, and it's tops! Answers on page 229



**1** You would fall through the floor, but for the fact that (a) wood is inflexible (b) action and reaction are equal and opposite (c) most of your weight is concentrated above your legs (d) the force of gravity diminishes with increasing altitude.

**2** Electric currents are led around paths called (a) orbits (b) channels (c) trajectories (d) circuits.

**3** Iridium might be found (a) in a list of famous military strategists (b) at the tip of the point of a fountain pen (c) on a map of ancient Greece.

**4** "Offset" is a common term among (a) printers (b) snake charmers (c) assayers (d) piano tuners.

**5** Cats have kittens, dogs have puppies, and whales have (a) colts (b) pullets (c) calves (d) pups.

**6** In chemistry, a radical is (a) any member of the "halogen family" (b) a substance less soluble in hot water than cold (c) a group of elements in a compound that react as one.

**7** To find out how fast a shaft is turning, you would use a (a) pyrometer (b) tachometer (c) pedometer (d) bolometer.

**8** If you adjust your car's carburetor to use a minimum of gasoline, the fuel mixture is called (a) dry (b) rarefied (c) lean.

**9** All of these animals are misnamed, except the (a) prairie dog (b) guinea pig (c) mountain sheep (d) horned toad.

**10** The cathode of anything is (a) what you should take if you are poisoned by it (b) the shape it assumes when unrolled (c) its negative pole (d) the place where you look into it.

**11** To save time in reading aloud the number 3.14159... , just call it (a) pi (b) mu (c) delta (d) gamma.

**12** Shellac is obtained from (a) pine trees (b) a scale insect (c) sea water (d) coal tar.

**13** Your muscles are connected to your bones with (a) adenoids (b) ganglions (c) tendons (d) follicles.

**14** Chemists support glassware in the proper position for an experiment with (a) head stands (b) ring stands (c) band stands.

**15** Sun spots are caused by (a) planets crossing in front of the sun (b) interference of light rays (c) storms on the sun (d) defects in the human eye.

**16** Rivets are commonly subjected to the kind of stress known as (a) shear (b) torsion (c) compression.

**17** A magnet having only one pole (a) makes a good compass (b) may be found in a telephone receiver (c) is used for lifting loads of steel (d) doesn't exist.

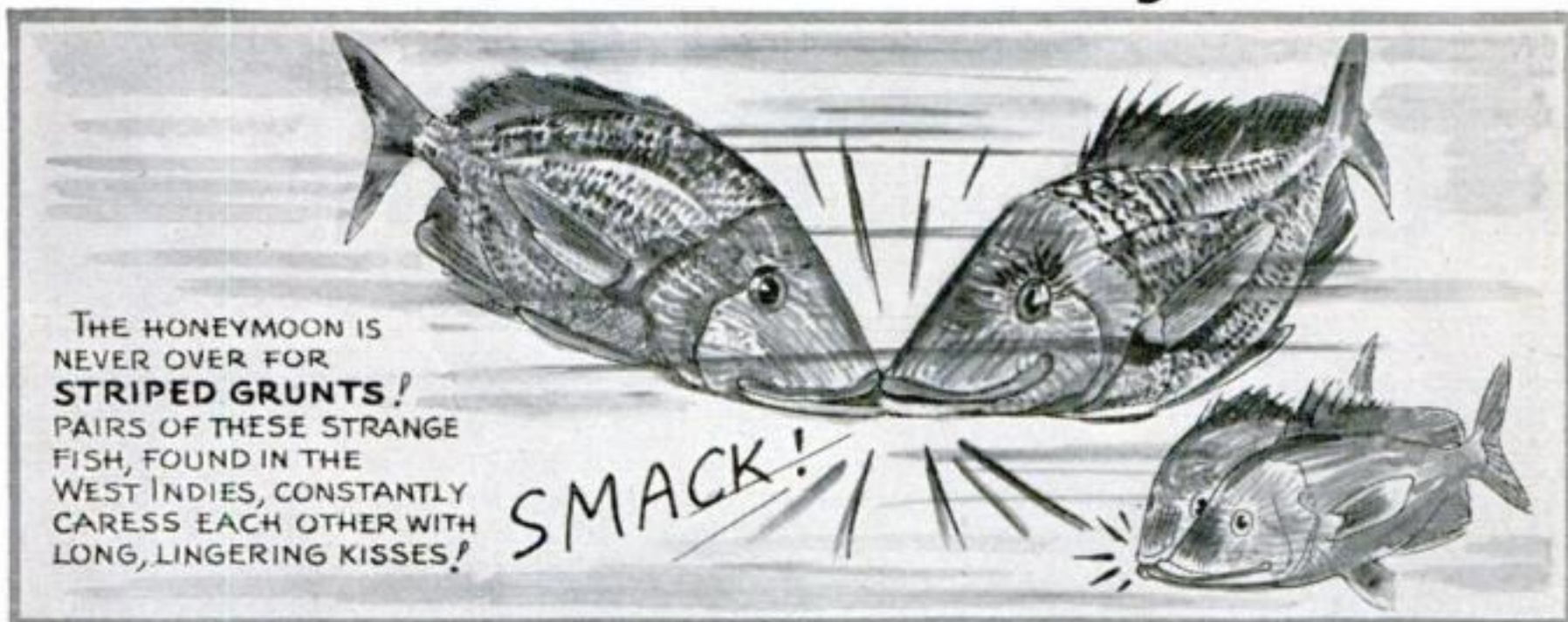
**18** The warmest air in a room is generally at the (a) bottom (b) middle (c) top.

**19** You would use tourmaline tongs to (a) get a cinder out of your eye (b) toss red-hot rivets (c) demonstrate the polarization of light.

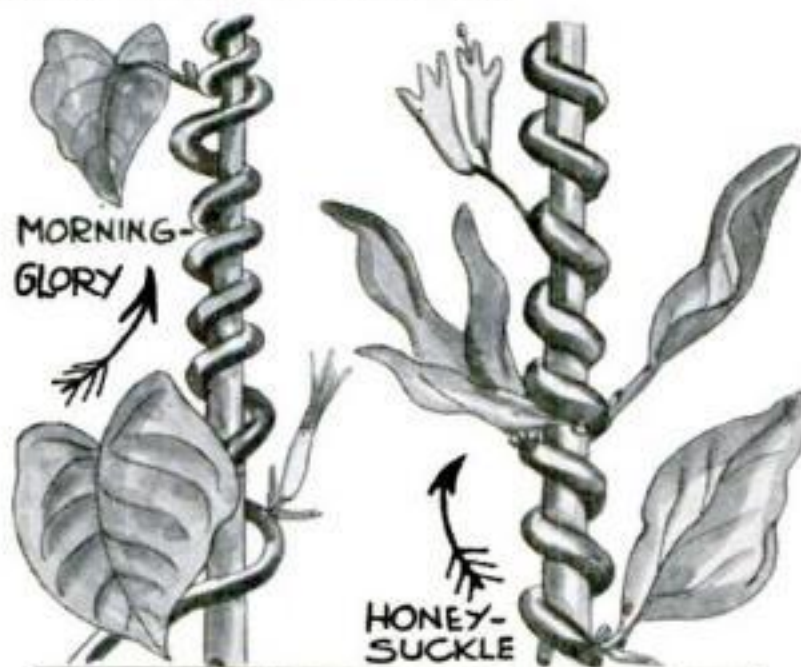
**20** A parallelogram of forces is (a) a modern British military formation replacing the old-time hollow square (b) a graphical solution for finding the combined effect of mechanical stresses (c) the distribution of power among the President, Congress, Supreme Court, and people.



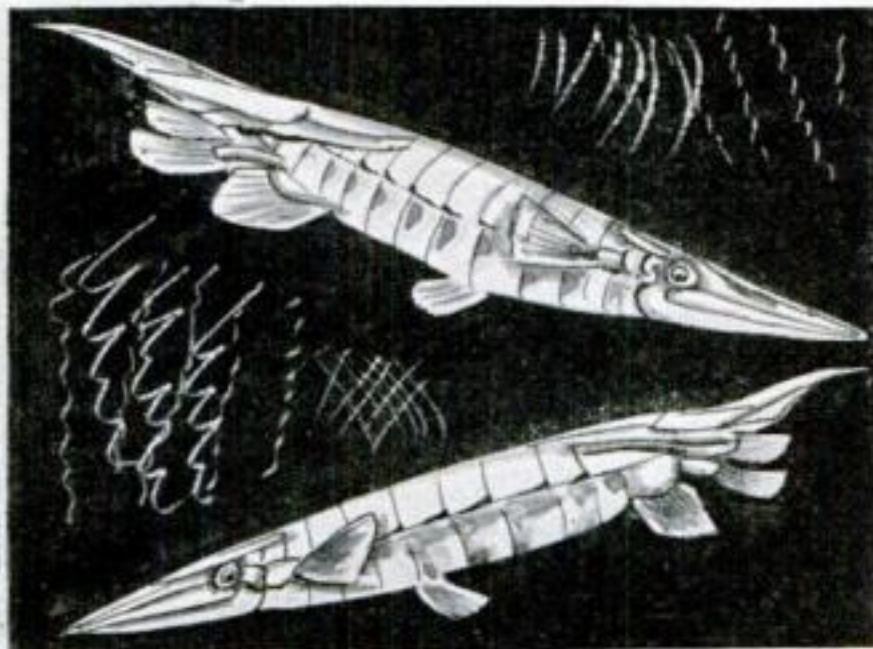
# Un-Natural History *By Gus Mager*



**HOP VINES** AND SOME **HONEYSUCKLES** TWINE CLOCKWISE ABOUT A POLE, BUT **MORNING-GLORIES, BEANS,** AND MOST COMMON VINES ALWAYS TURN IN THE OPPOSITE DIRECTION!



WHILE THE MALE **NARWHAL** IS ARMED WITH A FORMIDABLE-LOOKING TWISTED TUSK, SOMETIMES MORE THAN NINE FEET LONG, IT NEVER USES ITS POWERFUL SWORD AS A WEAPON!



INSTEAD OF SCALES, THE TINY **SHRIMPFISH** WEARS A TRANSPARENT, BONY ARMOR THAT COMES TO A SHARP POINT AT THE SNOUT AND TAIL!



GUS TELLS:

# Why Car Fires Start

**B**IG Ez Zacharias pushed his weather-faded postman's cap farther back on his shaggy head and expertly lobbed a mouthful of tobacco juice fifteen feet into the waste box which stands under Gus Wilson's workbench.

"High-angle fire," remarked Gus, "You ought to join the Army, Ez. They could use you for a howitzer."

Ez grinned. "I got used in the last war," he said. "I got used so much they darned near used me up. If the U. S. A. ever does any more fightin' over there in Europe, I'm a-goin' to pass up the A. E. F. and stick to the old R. F. D.—give some young feller a chance to be a hero. Harry, here, for example."

Harry, the Model Garage's grease monkey and budding mechanic, stuck his chest out an extra inch. "I'm in the National Guard," he said. "Anti-aircraft artillery."

The postman bit a conservative half-inch chew off a stick of black plug. "Now ain't that somethin'," he said, unimpressed. "Well, I hope they learn you to shoot airplanes better'n you shoot trouble on my bus. You checked my wirin' day before yesterday, didn't you? And you told me it was O. K., didn't you?"

"Sure I did. And your wiring *was* O.K.," Harry maintained stoutly.

"O.K., hey?" Ez grunted. "Last night I got on that dirt road back of Pleasanton, and what happened? Same darned thing that happened before you checked my wirin'. I hit a bump pretty hard, an' all my lights went out. Fuse blowed—same as before. It happened three times more, young feller!"

Harry looked so crestfallen that Gus spoke up in his defense. "Quit riding Harry," he told Ez. "If there is something wrong with your wiring that he didn't find, the chances are that neither I nor anyone else would have found it first crack out of the box. Maybe we can find it now. Open her up, Harry."

He glanced over the wiring up front,

and shook his head.

"Looks all right, and as Harry tested everything, it must be all right." He walked around to the rear of the car. "Let's have a look at the tail-light wiring." The tail light was mounted on the trunk door. He raised the door and examined the wires. "Looks all—wait a minute! Here's a bare spot on one of the wires—the insulation is worn right off."

"Shucks," Ez said, "I know all about that, and even Harry spotted it. That there wire ain't been doin' any harm. It's been that way since way back last fall, months before I began having any trouble. That new bird dog of mine done it. The darn-fool pup gnawed the insulation right off while I was eatin' my lunch one day I was out gunnin'. The bare place ain't near any metal, so it can't make any difference."

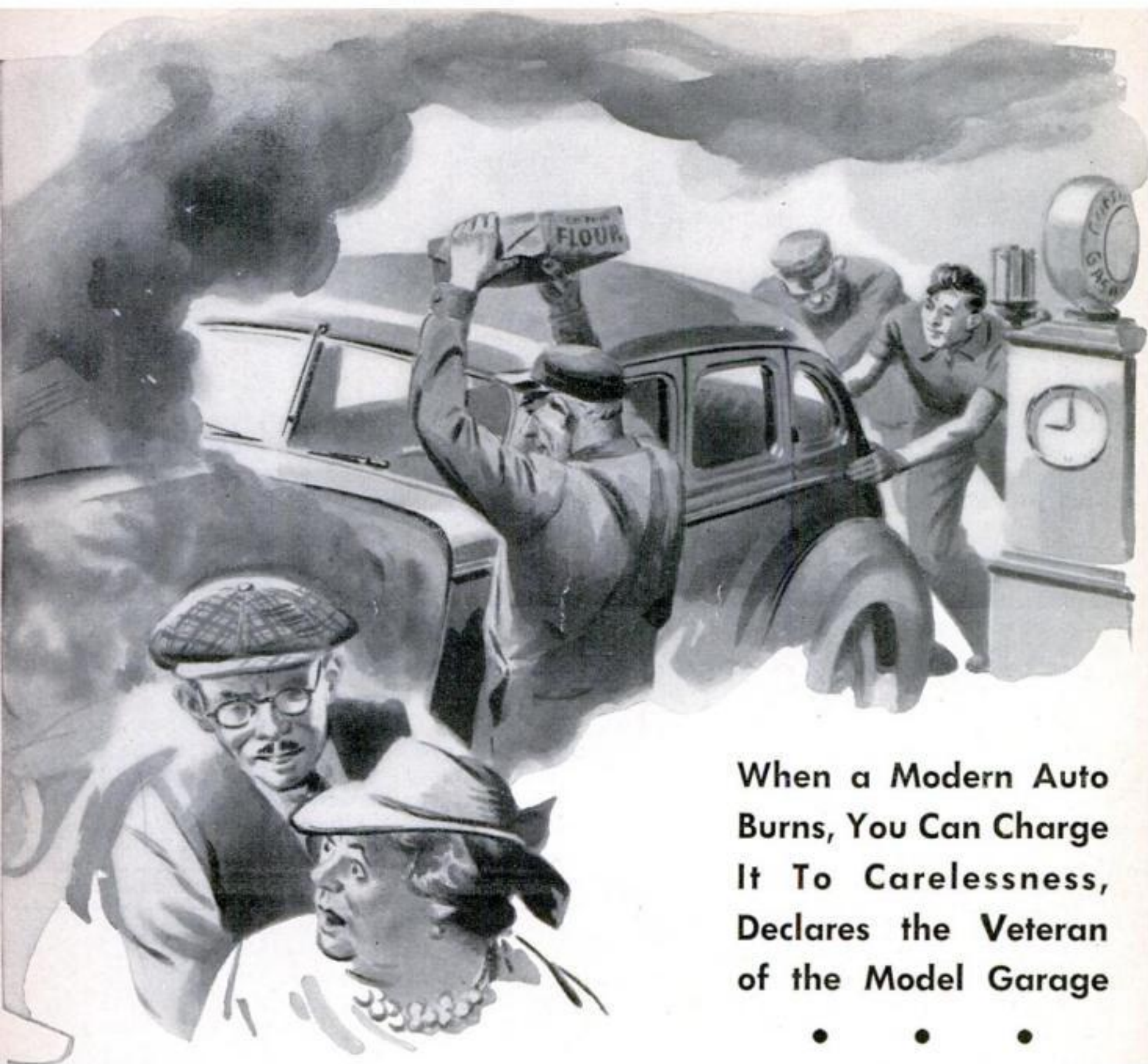
"I was going to tape it over, but I forgot it," Harry confessed to Gus in some embarrassment.

Gus didn't say anything. He lowered the door carefully, stooping so that he could keep his eyes on the wires, which looped down to within a couple of inches of the top of an open tool box when it was closed. He raised the door again, and stood looking at the tool box, which was empty except for a folding jack. Then he went over to his bench and brought back a small wooden box, which he pushed under one end of the jack. "Switch on the lights," he told Harry.

Harry switched on the lights. Gus lowered the door again. As it closed, the car's lights went out. Gus laughed. "Better put in a new tail-lamp wire, Harry," he said. "And a new







When a Modern Auto  
Burns, You Can Charge  
It To Carelessness,  
Declares the Veteran  
of the Model Garage

• • •  
By MARTIN BUNN

As Harry and Ez pushed the car away from the pump, Gus threw the flour sack at the flames

fuse." He turned to Zacharias. "There's your trouble," he said. "That jack was lying in exactly the right position to bounce up and come into contact with that bare place on the wire. Whenever you hit a bump hard, that's what happened—the jack bounced up, hit the wire, short-circuited your lighting circuit, and blew out your fuse."

"I'll be derved!" said the postman. "Well, now, I call that pretty smart, dopin' that out. If you hadn't—"

Ez never finished that remark. It was interrupted by the frantic squawking of an automobile horn outside the shop doors, and by Joe Clark's voice, from the office, shouting urgently for Gus.

Gus got into the office just in time to see his usually calm partner sprint out through the front door. He ran over to the window and looked out. A sedan he recognized as Henry Miller's had been stopped close to the gas pump. Thick blue-black smoke was pouring out from under its hood. Mrs. Miller was crouching in the driver's seat, alternately punching the horn button and emitting heart-stopping shrieks of "Fire! Help! Fire!" Joe Clark was clawing at the shop doors, trying to get them open from the outside, and shouting something about an extinguisher.

Gus was out of the office and across the driveway to the car in two jumps. He pulled open the door. Mrs. Miller stared at him with panicky eyes, and let out another



screech of "Fire!" at the top of her voice.

"Take it easy, Mrs. Miller—take it easy," Gus said soothingly. "Nothing's going to hurt you. Just you hop out."

Mrs. Miller was too badly frightened to understand what he said, but when he reached in over an assortment of packages from the neighborhood chain grocery piled on the front seat, and grasped her arm, she slid out from under the steering wheel and stumbled out, still yelling shrilly.

Harry and Ez Zacharias came running over just then and together they pushed the burning car well away from the gasoline pump.

Harry got the hood up. Through the cloud of blue-black smoke that billowed out they saw that a greasy mess on the pan at one side of the motor was burning fiercely. "I'll get the extinguisher!" Harry yelled, and sprinted for the shop. Suddenly Gus remembered one of the grocery packages he had noticed on the car's front seat—a big paper bag. He reached in, found it raised it high above his head, and smashed it down onto the hottest part of the blaze.

The bag broke. A white cloud rose and mingled with the black smoke. The flames were blotted out as if a wet blanket had been slapped over them.

**H**ARRY came running out with a fire extinguisher. "Never mind that," Gus said. "We won't need it."

Harry's mouth sagged open. "What—what didja put it out with?" he sputtered.

Gus laughed. "A long time ago," he said, "I read some place that flour will smother a gasoline or oil fire just about as effectively as sand will. I remembered that when I noticed that Mrs. Miller had a ten-pound bag of flour on her front seat. And it worked!"

Excitement died down with the fire. Ez Zacharias drove away. Even Mrs. Miller recovered sufficiently to come out and make a survey of the damage. "You saved me, Mr. Wilson—definitely saved me!" she gushed. "But my poor, *poor* car! Whatever will Mr. Miller say? It's ruined—I'm sure it's ruined!"

"Oh, it's not that bad," Gus consoled her. "Not nearly that bad. You're going to need a new wiring job, but I guess that'll be about all. Better leave the car here—it won't run—and tell Henry to drop over and see me about it. Harry will carry your packages over to your house for you."

Gus and Joe watched Harry escort the still-talking Mrs. Miller down the street. Then they looked at each other. "What a dame!" Joe said bitterly. "Imagine! Parking a burning car right up against our gas pump!"



He lowered the door, stooping to watch the wires

Somehow news of the fire got around town, and along after five o'clock, quite a little crowd of the Model Garage's steady customers, who had dropped in to discuss Mrs. Miller's latest motoring misfortune, were gathered in the shop.

"You don't see, or hear about, nearly so many car fires as you used to," remarked George Knowles, who has been driving since the Maxwell was a headliner.

Gus nodded agreement. "You're right, George," he said. "And most of the fires we have don't do much damage. Well, it's easy to see why—automobiles are designed better and built better than they used to be."

"But," some one objected, "there still are car fires. What causes most of them, I wonder?"

"I was talking to a fire-insurance claim man about that only a couple of weeks ago," Gus said. "He told me that about half the car fires are cigarette fires that don't burn anything but the upholstery, and that nearly all of the other half are caused by defective wiring. Either way, the underlying cause is the same—carelessness."

"How do you make that out?" Knowles wanted to know. "I'll admit that probably most cigarette fires are caused by carelessness, but I don't see how a fellow can guard against his wiring suddenly going wrong."

**T**HAT'S just the point," Gus told him. "Wiring doesn't go wrong *suddenly* once in a hundred times. When you buy a new car its wiring practically always is all right. But after a few thousand miles of driving, things begin to happen to the wiring—if the driver of the car, or the mechanic who takes care of it, is careless."

"Trouble in a wiring system develops *gradually*—sort of sneaks up on you. A short circuit in the low-tension system isn't likely to cause a fire, although it always is a nuisance. But (Continued on page 234)



# THE HOME WORKSHOP



*In This Issue...* **OUTDOOR FIREPLACES • ODD JOBS  
SHOP AND AUTO KINKS • ELECTRICAL WORK**



By HI SIBLEY

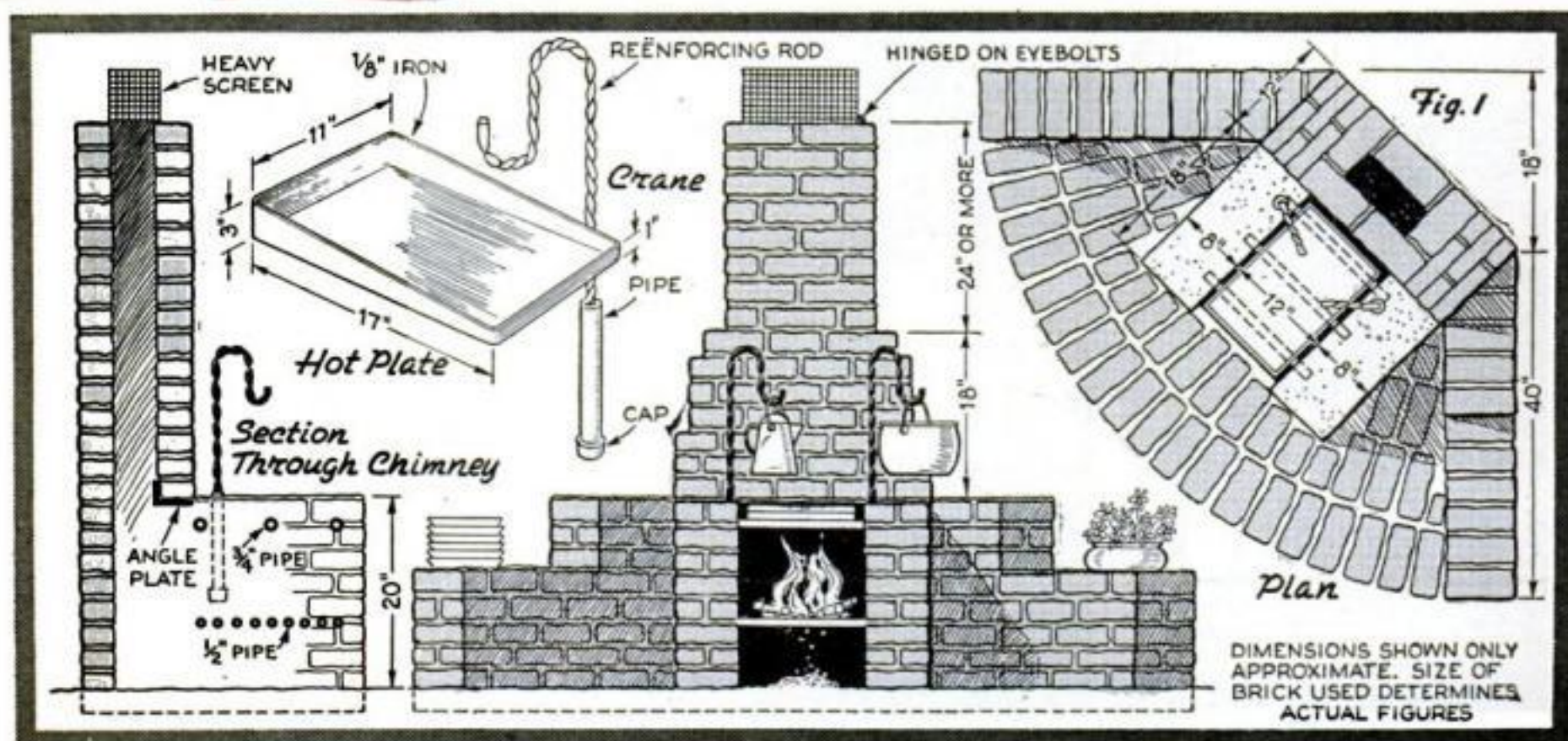
# INEXPENSIVE Garden FOR SUMMER

ENTERTAINING outdoors with picnic suppers is so easy and pleasant that the garden fireplace has justly gained nation-wide popularity. Several especially practical designs of various types are shown in the accompanying illustrations. None of these is difficult or expensive to build.

Bricks are the most convenient material because laying them up is almost as simple as building a house of blocks. Used bricks from a dealer in secondhand building supplies are good enough, and these sometimes can even be had for the hauling away. Field stones, which also make an attractive fireplace, can be picked up for nothing in many localities.

The fireplace shown in Fig. 1, which was submitted by Matilda Rose McLaren, of Springfield, Ill., has many conveniences, and takes up little space.

The cranes for hanging pots and kettles are





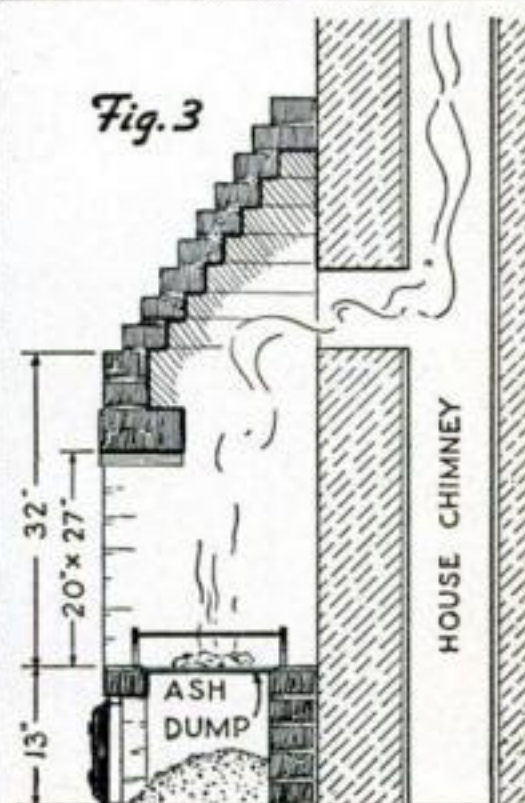
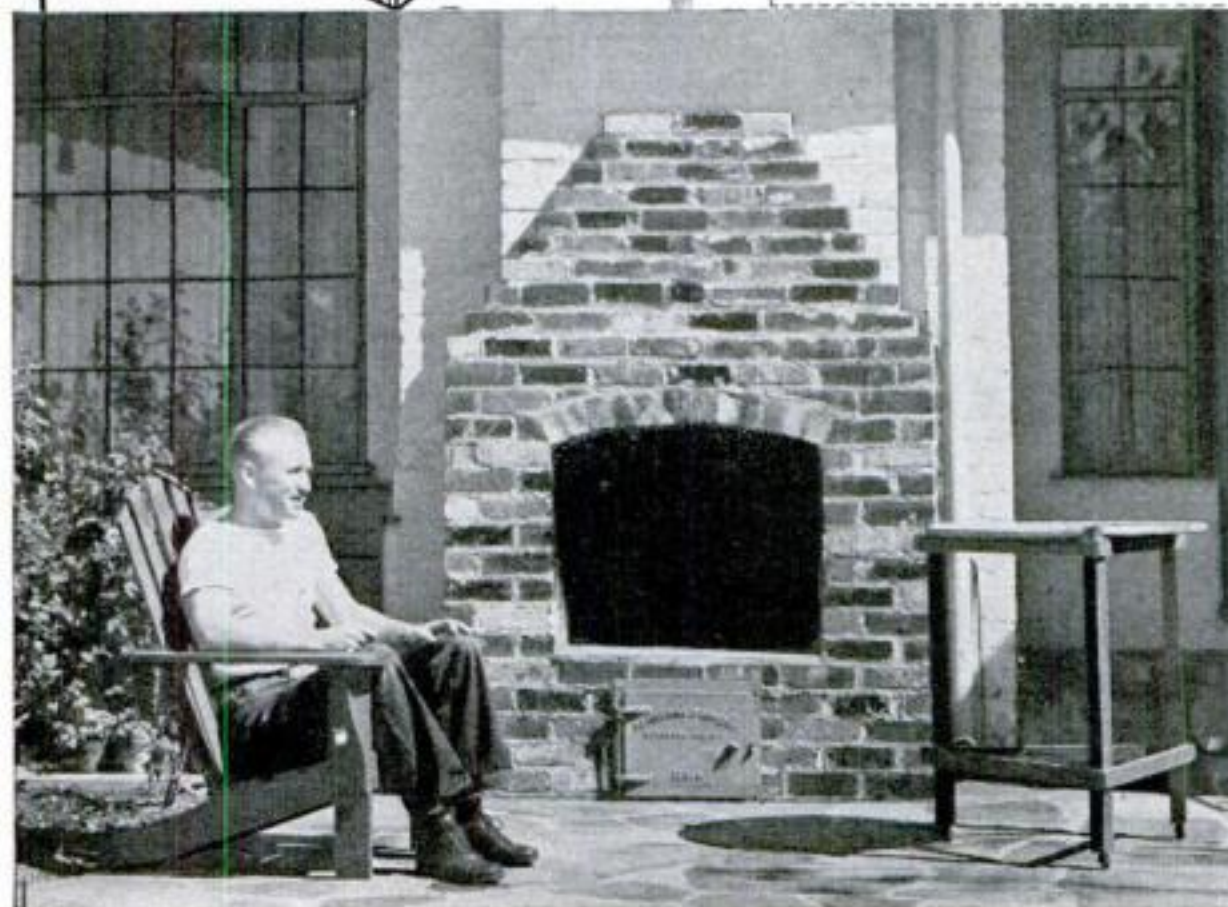
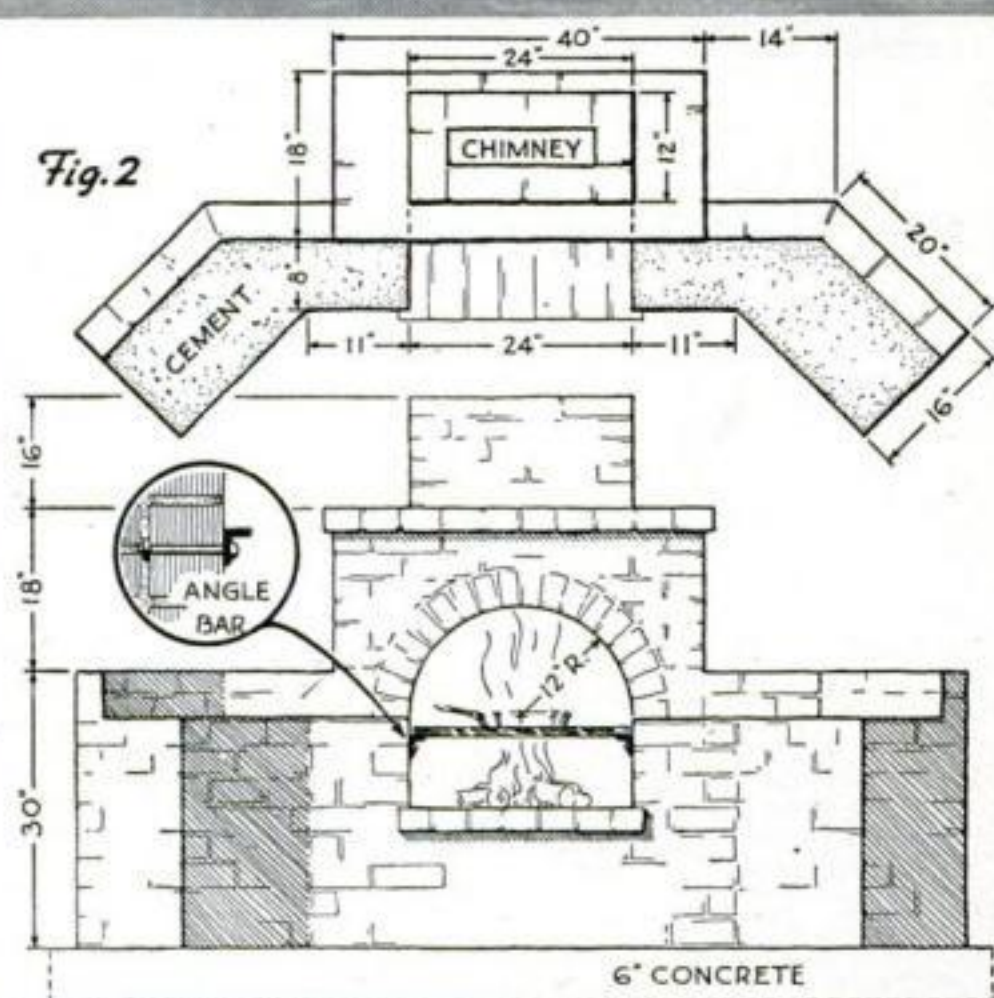
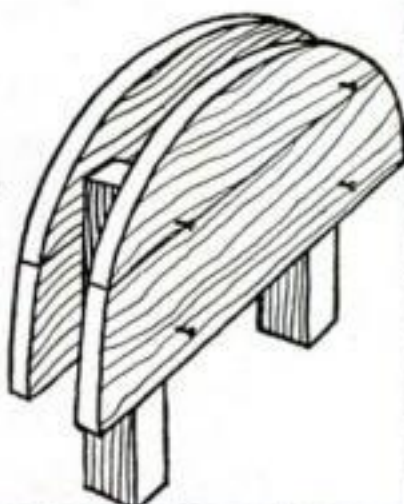
# Fireplaces

## PICNICS AT HOME

an original feature. These consist of pieces of reënforcing rod bent to shape and turning in pipe sockets embedded in the brickwork. When the coffee has boiled, the pot can be hung over the heat or swung out of the way.

A rectangular pan, made to order at a tin shop, serves both as hot plate and frying pan. It is much better than round frying pans, which do not hold enough for a large party supper and then become too sooty to use in the house without a thorough scrubbing after each picnic. The pan covers the entire opening above the fire, and

ROUGH FORM FOR LAYING UP ARCH. NAIL LOOSELY SO THAT SUPPORTS CAN BE KNOCKED OUT





being higher in back prevents cinders from dropping into the food. A spark arrester is advisable; in fact, some cities require them. This one is made of heavy mesh screen and hinged to tilt back for periodic cleaning.

For this fireplace, as for all others that are intended for permanent use, some thought must be given to the question of a suitable foundation. In Southern California, where the art of building garden fireplaces has shown the greatest advance, it is not necessary to take many precautions to avoid the settling and cracking of the masonry, but in localities where the winters are severe and the ground freezes deeply, a good foundation must be provided.

In a mild climate it is sufficient, with a fireplace like that shown in Fig. 1, to excavate a few inches deeper than the depth of a brick and make a fill of sand or cinders, well tamped down, to insure drainage and give a level bed for the brickwork. In northern localities, on the other hand, a solid concrete slab like a garage floor is desirable, at least 6" and preferably 8" thick, reinforced with rods or 40-lb. mesh. It is often a good plan to make a cinder or gravel fill 6" deep under that, although this depends to some extent upon the type of ground.

A more elaborate corner fireplace is that of S. McDonald, Pasadena, Calif., shown in Fig. 2. This also has side wings to serve as seats, or shelves. The grilling is done over the open fire, which is raised to a convenient level. Angle bars are secured with bolts set

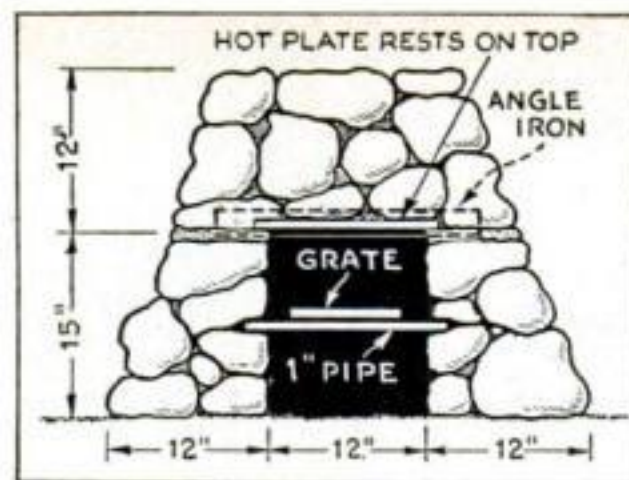


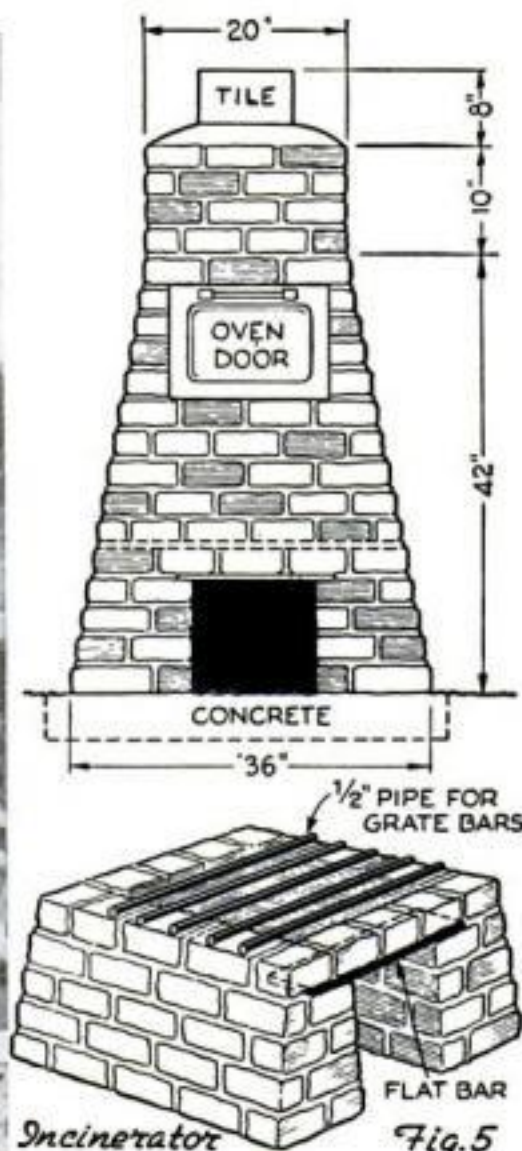
Fig. 4

in the brickwork, and the hot plate or grill is slid in over them. Some builders install angle bars or rails at two different levels, the low ones for a charcoal fire and the ones on the upper level for a wood fire.

This fireplace should be built on a concrete foundation at least 4" thick and preferably 6" or even 8". The top surfaces of the wings are cemented over for smoothness.

When the house chimney is conveniently located for the purpose, an outdoor fireplace can be built against it, with a flue cut through the outer wall, as in Fig. 3, which shows the fireplace of F. F. Newton, San Marino, Calif. However, a damper should be installed to prevent drafts into the indoor fireplace when the outer one is not in use. In building onto a chimney in this way, it is best to consult a contractor as to the proper procedure.

One of the simplest as well as most satisfactory barbecues is illustrated in



Incinerator

Fig. 5



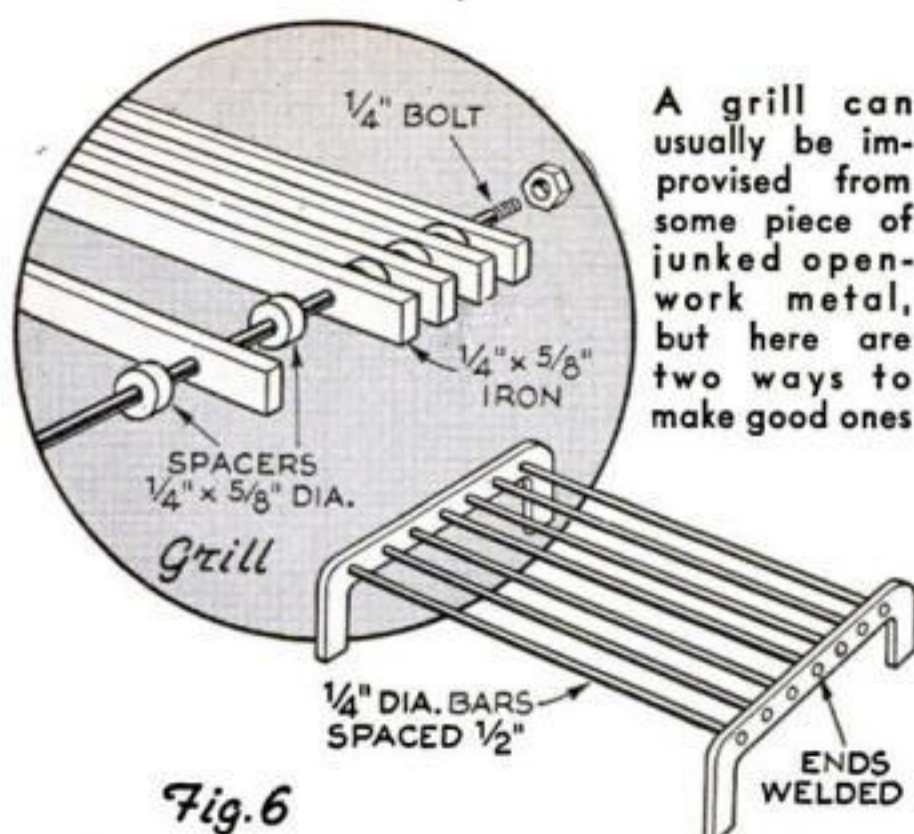


Fig. 6

Fig. 4. The original fireplace cost practically nothing except for cement and sand. Field stones were used throughout, and old grate bars were supported on gas pipe. An angle bar picked up in a junk yard supports the forward wall of the chimney, and a piece of boiler plate serves as stove lid. This lid rests directly upon the cement tops. The

A grill can usually be improvised from some piece of junked openwork metal, but here are two ways to make good ones

low chimney is adequate when the fireplace is not located near buildings or too close to a neighbor's property line.

In case a fireplace is not required, but only an incinerator, one highly satisfactory design is given in Fig. 5. This was built for little more than the cost of the brick. A discarded oven door was used, and gas pipe was embedded in the masonry for the grate bars. A section of flue tile serves as the chimney, and it is high enough to carry off unpleasant odors. This type of structure should be built on a concrete bed.

Almost any openwork piece of metal will do satisfactory duty as a grill. Even a certain type of doormat that has a metal web supporting fiber has been used successfully after the fiber had been thoroughly burnt out. Heavy, perforated sheet iron is also good. Two more substantial types of grill are illustrated in Fig. 6. One is assembled from flat bars, thick washers, and long bolts. The other requires some blacksmith work, but is worth the cost. The height depends upon the sort of fire used under it.

The dimensions given in the drawings are only approximate, because each fireplace must be designed to fit the space available.

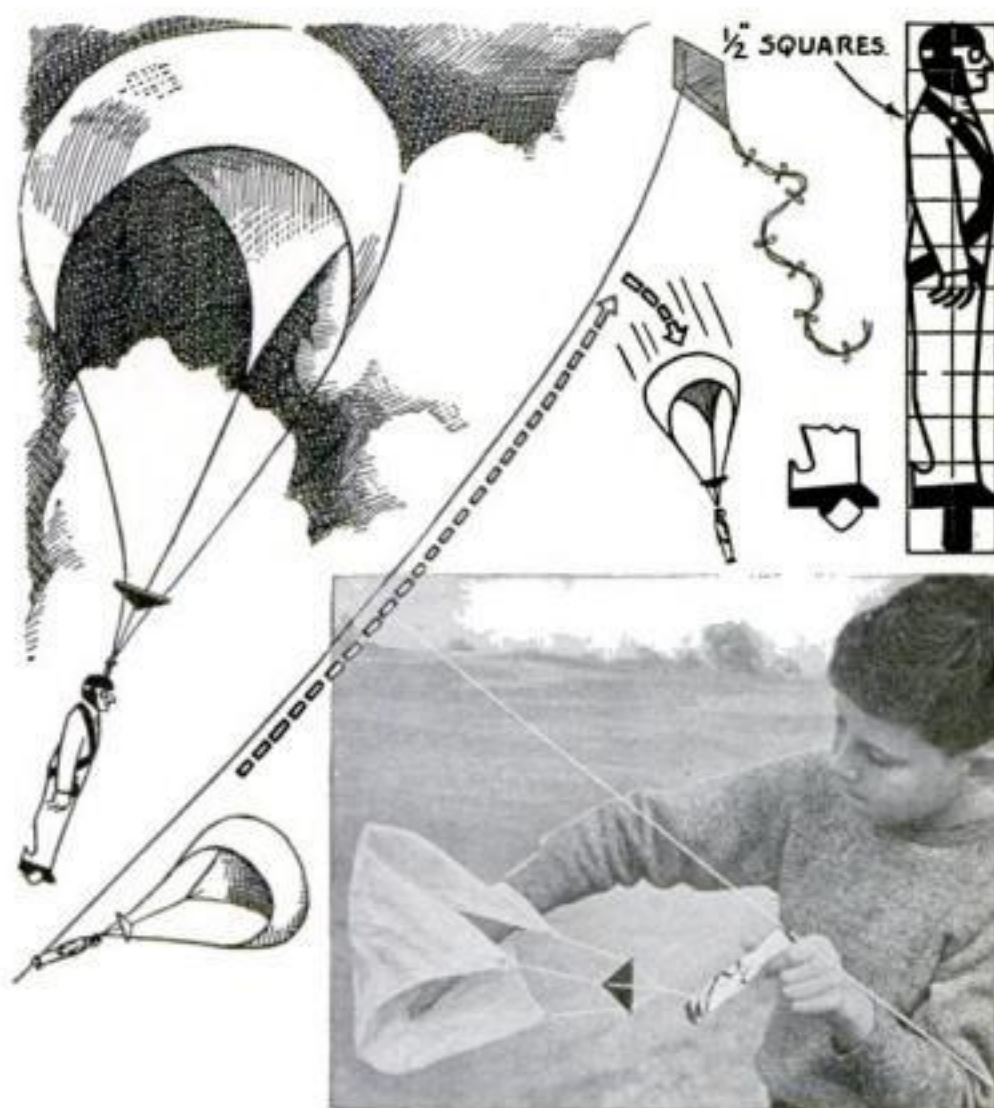
## Parachute Jumper Bails Out from Kite String

A PARACHUTE performer who climbs a kite string and bails out perfectly at the will of the kite flyer can be made as illustrated. The toy was designed by Charlie Wunder, of Long Beach, Calif.

Materials: A strip of tin plate 1" by 6"; tough tissue paper to make a 20" equilateral triangle; stiff cardboard to make a 2" equilateral triangle; three 8" lengths of kite cord.

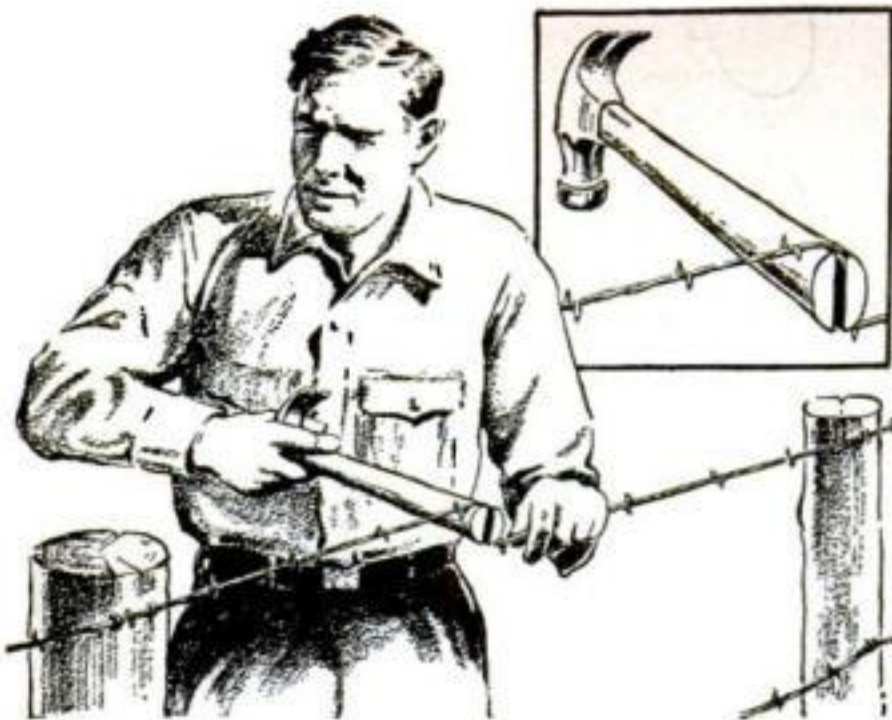
The figure is cut out as shown. A 1/2" tab is left on at the bottom and bent over at an angle to form a sort of hook or grove to slide along the kite string. For smoother operation, a piece is also cut out of the back of the leg near the bottom as indicated.

The shrouds are kept from tangling and twisting by the 2" cardboard triangle, the corners of which are slotted. A hole is punched through the man just below the head, and the ends of the shrouds are run through this hole and knotted. Another knot is made about 2" from the base of the shrouds, between the head of the parachute jumper and the small triangle. The shrouds are glued to the corners of the parachute, with a small square of paper added to keep them from tearing out.



The parachute jumper is hooked on the kite string in an inverted position, and the wind carries it up. A sharp jerk on the string then releases the figure and he parachutes down.—RAY G. FUNKHOUSER.





## Notch in Hammer Handle Tightens Fence Wire

TO TIGHTEN strands of fence wire by the kinking method, one farmer sawed a wide notch in the end of his hammer. This does the work quickly and with less danger of injury to the fingers than when the claws of the hammer are employed in the usual way.

## Lathe-Spindle Adapter Made from Old Drill



WHEN I bought a new wood-turning lathe, it had a No. 1 hollow Morse taper spindle, but my sanding disk and other accessories had collars on them to fit the  $\frac{1}{2}$ " shaft of the old lathe I formerly owned. To use them, I made a mandrel as shown by cutting down an old  $\frac{1}{2}$ " drill bit having a No. 1 Morse taper shank and filing down the cut-off end in the lathe to a diameter of  $\frac{1}{2}$ " to fit the collar.—T. G. HETRICK.

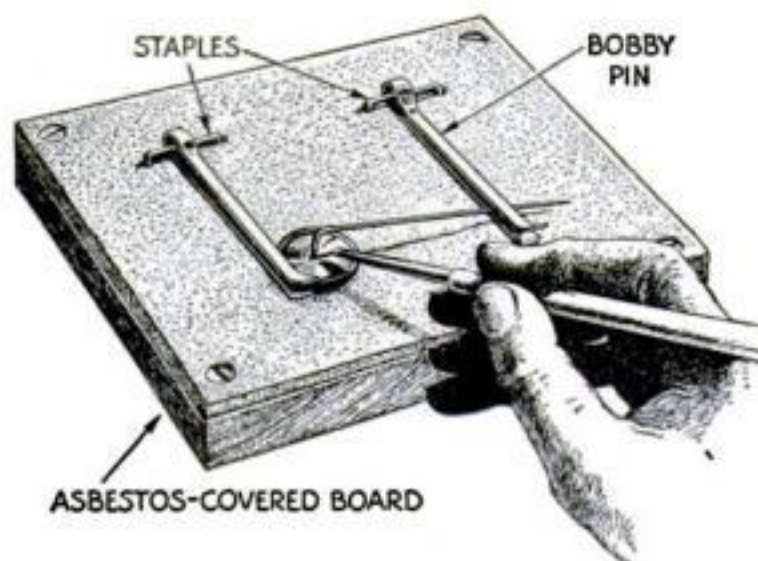
## Substitute Ink for Stamp Pad

IF STAMP-PAD ink cannot readily be obtained, a good substitute may be prepared by grinding an inch of indelible pencil in a tin can with a teaspoonful of water and a teaspoonful of glycerin. Allow the mixture to settle overnight before using.—R. W.



## Bobby Pins Clamp Parts While Being Soldered

BOBBY pins are useful for holding down very small work to be soldered. They are fastened down with staples, as illustrated, on an asbestos-covered board or block. The work is slipped between the spring prongs.



## Glass Disks Quickly Cut on Lathe Faceplate

A DISK of glass can easily be cut on a wood-turning lathe. Fasten a board to the faceplate and then mark the size of the disk. Attach the glass over the circle with thumb tacks. Hold the glass cutter with one hand on the pencil line and turn the faceplate with the other. Take off the glass and cut a series of straight lines about 1" apart from the circumference outward. This enables you to break off the narrow waste pieces one after another.—RUDOLPH KNAUS, SR.





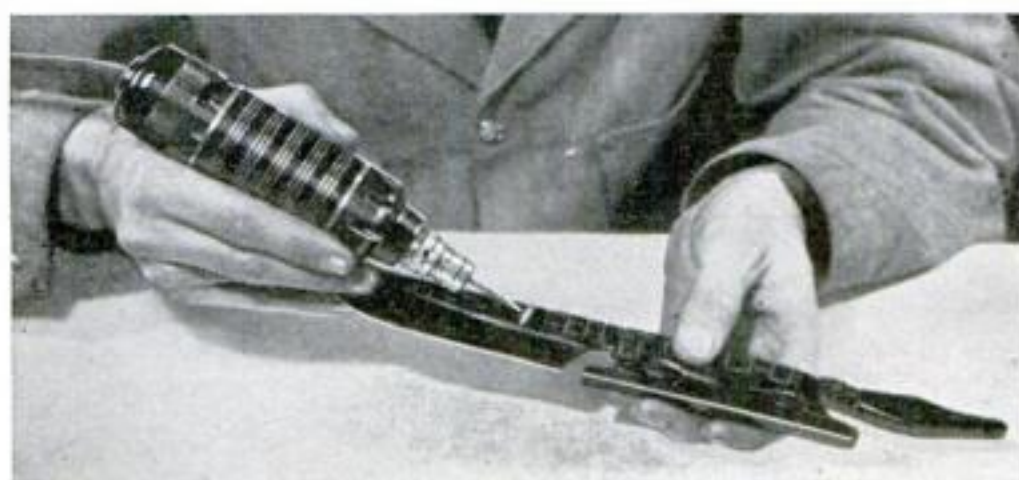
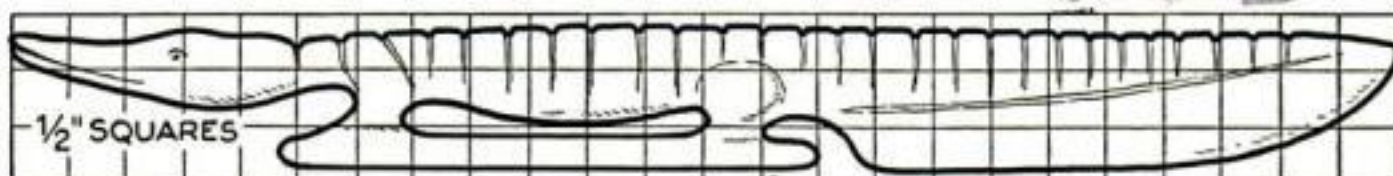


# Letter Opener

CARVED FROM JET-BLACK PLASTIC

**S**HAPED like a crocodile, this letter opener forms an attractive desk ornament. It is made from jet-black cast-resin plastic, although ebony and other hard materials might be used instead.

The stock needed is 12" long, 1 1/4" wide, and 1/2" thick. First cut the outline with a jig saw. Then carve out the body, legs, and blade with a bud-shaped cutter in a hand motor tool, if available. The lines on the body are outlined with a V-edged grinding wheel. High polish is obtained in the usual way by first buffing with a paste of pumice and water, then with a waxing compound supplied by plastic manufacturers, and finally with a dry buff. Use a high-speed muslin buffing wheel if available.—K. M. SWEZEY.



Layout for the letter opener and, left, carving it with a hand motor tool. The design was worked out by the Metropolitan Junior Achievement, New York

## Clamp-on Lamp Throws Extra Light on the Bench



A CLAMP-ON type of photoflood reflector is an ideal auxiliary light for the workshop. If a 50- or 60-watt lamp is used in it, concentrated illumination is provided for fine work at the bench. Screws and small parts dropped on the floor are quickly found by using the lamp as a portable searchlight.—JOHN C. MICHALEK.

## Renewing Jig-Saw Guide

WHEN the brass blade guide of a high-speed magnetic jig saw becomes worn and enlarged, simply cut another slot in it with a fine-toothed coping saw at right angles to the original one. In this way its service can be doubled.—HAROLD ROLSETH.



Cheese is easy to cut and serve on this board



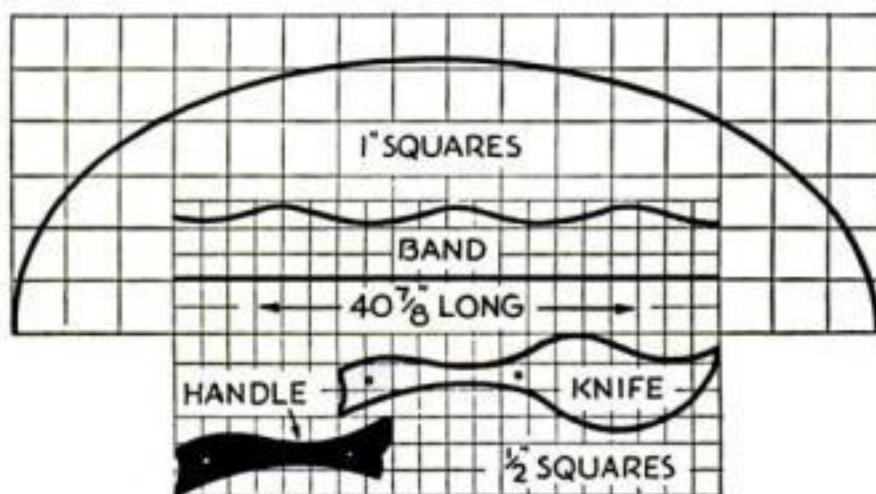
# ALUMINUM-TRIMMED Cheese Board IN MODERN STYLE



**T**HIS oval cheese board is cut from  $\frac{5}{8}$ " thick oak about 11" by 16" and has a wave-line band around it sawed from  $\frac{3}{32}$ " aluminum, smoothed with a file, and polished with steel wool. It is well to cut the aluminum band a trifle longer than necessary to allow for filing the ends to a neat fit. The wavy pattern is repeated thirteen times.

Flathead aluminum rivets 1" by  $\frac{3}{16}$ " hold the band on the board. The rivets are countersunk flush and polished. The holes for the rivets are drilled for a fairly tight sliding fit, and the rivets are tapped into place. A thin  $\frac{1}{2}$ " finishing brad is then driven through each rivet from the underside of the board after suitable holes have been drilled.

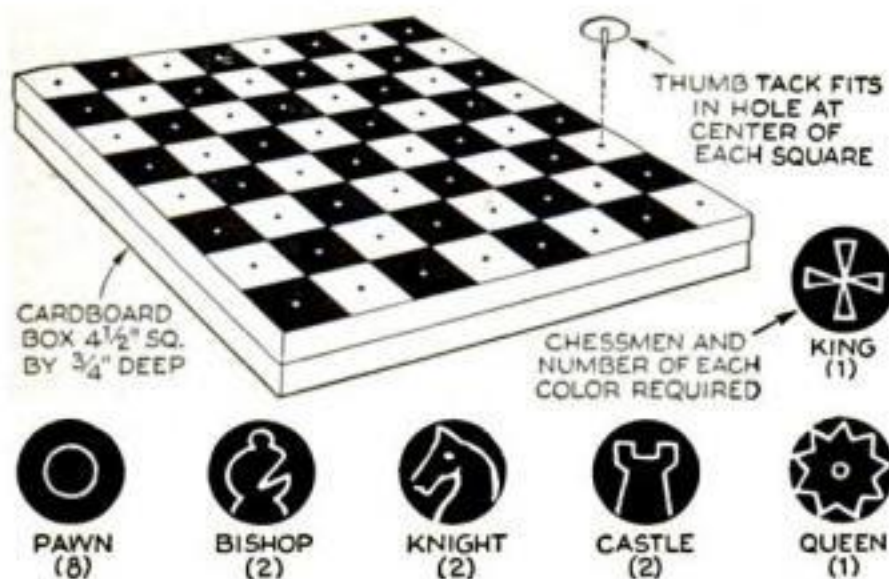
The four feet are of  $\frac{1}{2}$ " cylindrical aluminum bar cut in 1" lengths and fastened as shown with two countersunk screws apiece. The outer end of each is polished.



Layout for the various parts. The server blade is filed fairly sharp; the handle is dull black

The server is sawed from  $\frac{3}{32}$ " aluminum, and the two sidepieces of the handle are of birch about  $\frac{3}{16}$ " thick. The sidepieces are held by flathead aluminum rivets, countersunk flush.—BERTRAM BROWNOLD.

## Thumb Tacks Converted into Pocket Chess Set



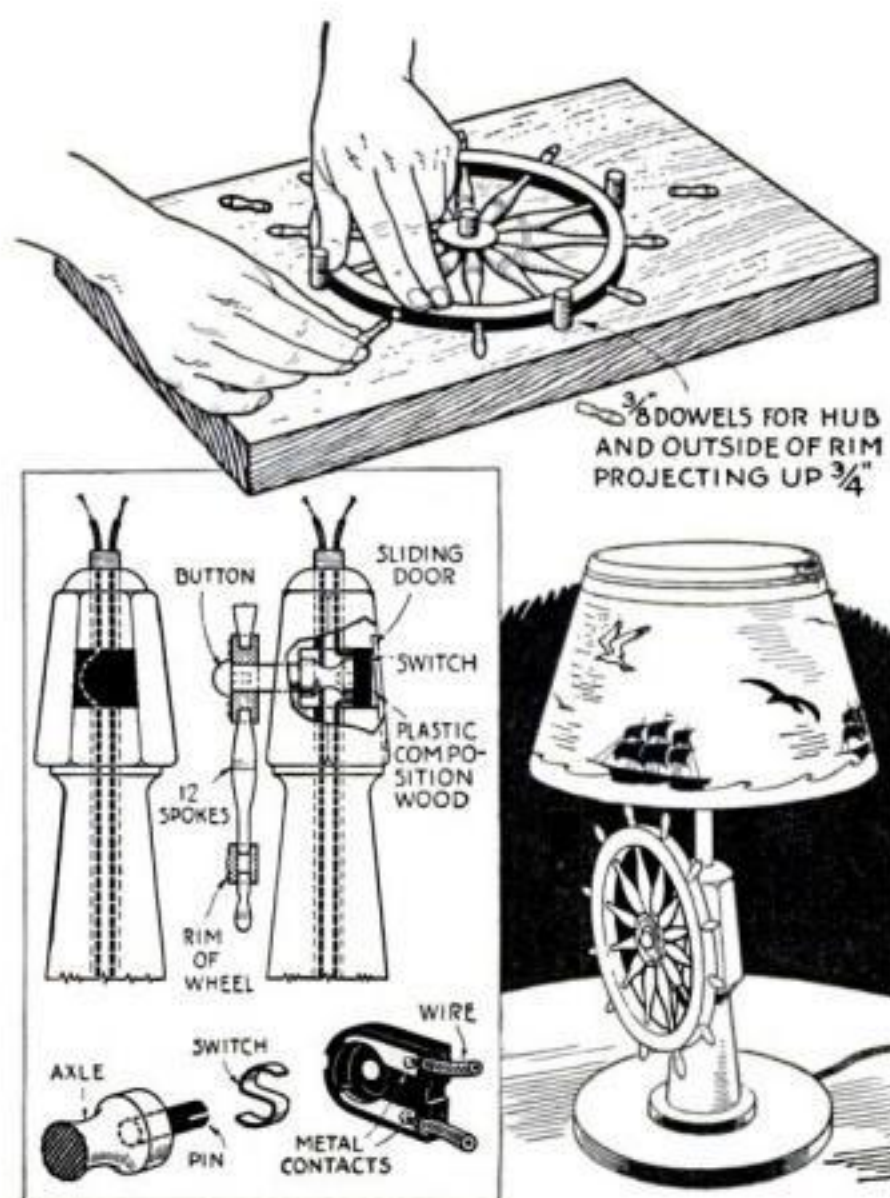
A POCKET chess set can be made for a few cents from sixteen thumb tacks with cream-colored metal heads, sixteen thumb tacks with maroon-colored heads, and a cardboard box about  $4\frac{1}{2}$ " square and  $\frac{3}{4}$ " deep. The tacks are made into chessmen by scraping lines through the enamel on the heads to form the patterns. This can be done with an awl or large needle. The top of the box is marked with ink to represent a chessboard, and a hole is punctured in the center of each square so a thumb tack can be dropped in.—JEROME DUKOFF.



## Improved Switch Operates Ship's-Wheel Lamp

SHIP'S-WHEEL lamps are popular among amateur craftsmen, but usually the switch arrangement is a makeshift that utilizes a pull-chain socket. A more workmanlike switch is the one illustrated below. To make it, a canopy switch is dissected. After the composition pin has been removed, it is glued into the axle of the wheel, and the switch mechanism is placed in an opening in the back of the lamp. The opening is closed by a dovetailed sliding cover. A quarter revolution of the wheel operates the switch, and in this case, of course, a keyless socket is used.

The drawings also show the type of wheel the writer uses for these lamps and a jig for assembling them.—E. H. RICE.



## Folding Tomato Racks Are Easily Stored

COLLAPSIBLE tomato racks may be made as shown from 1" by 1 1/8" by 3' 6" strips of wood and 8-gauge wire. Run the wire through holes drilled in each set of four sticks and splice to form two rings about 15" in diameter. The bottom ends of the sticks are sawed to a pointed shape. Paint the wood.

In use, the strips are slipped around and spaced on the wire, then placed over the small plants. As the plants grow, the branches are trained over the wires. The racks will last for years if stored away each winter.

## Seven Twist Drills Kept Handy in Old Distributor Cap

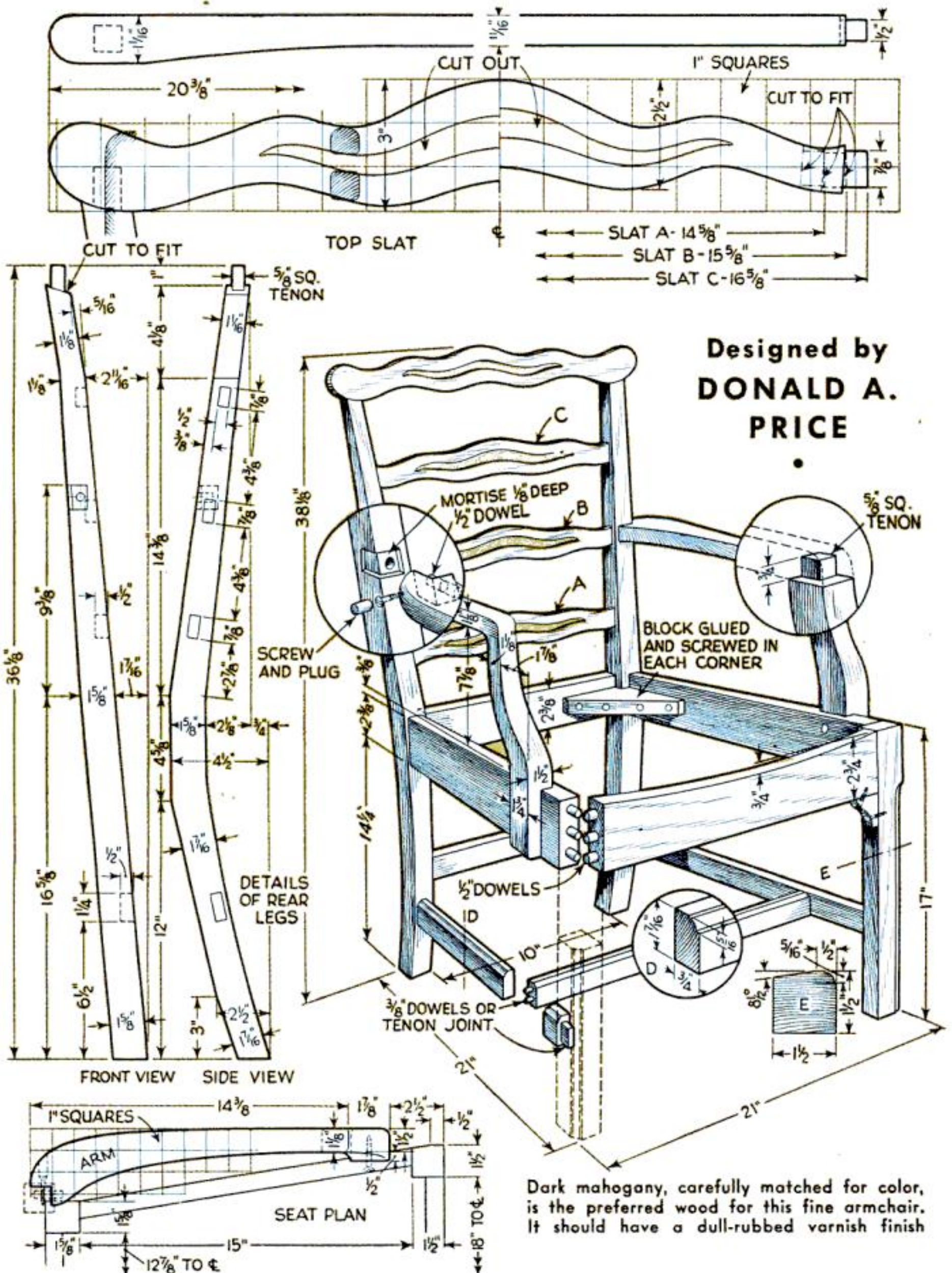
ANOTHER use for distributor caps from old automobiles is to hold twist drills of some of the most commonly used sizes. Each one will hold seven bits as shown at right.

TO PREVENT left-over putty from drying, wrap it in wax paper and immerse in a can of water. When it is to be used again, soften it with hot water.





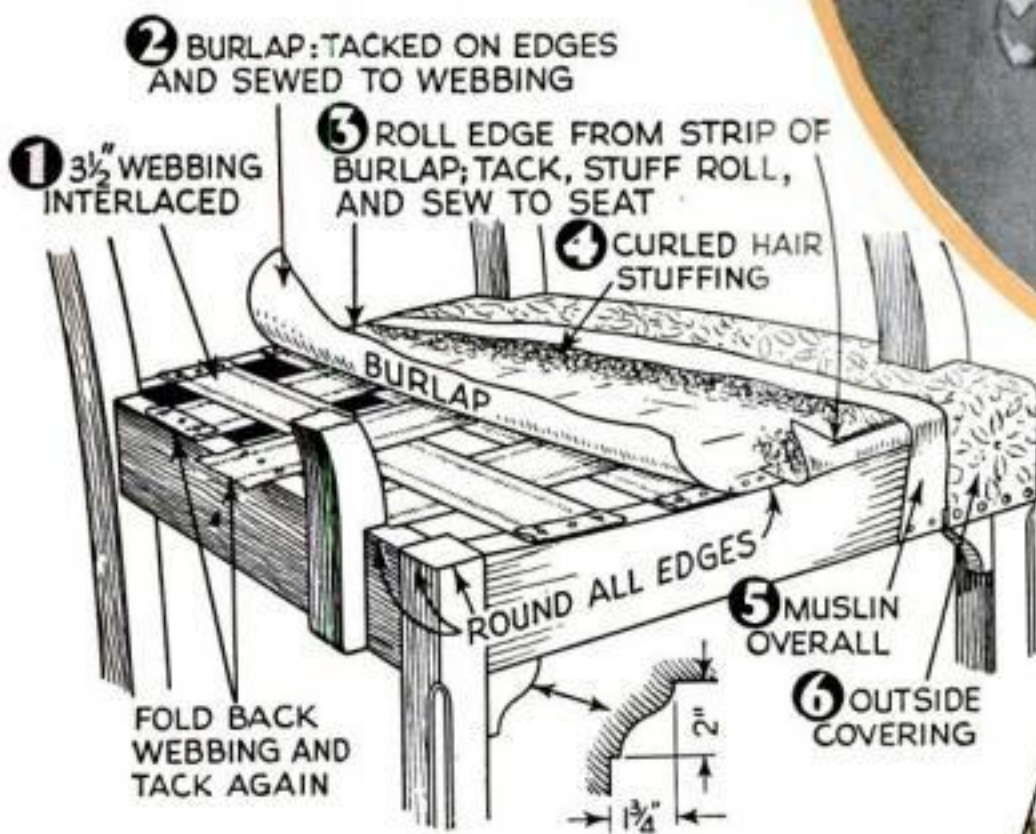
# Chippendale Slat-Back





# Armchair

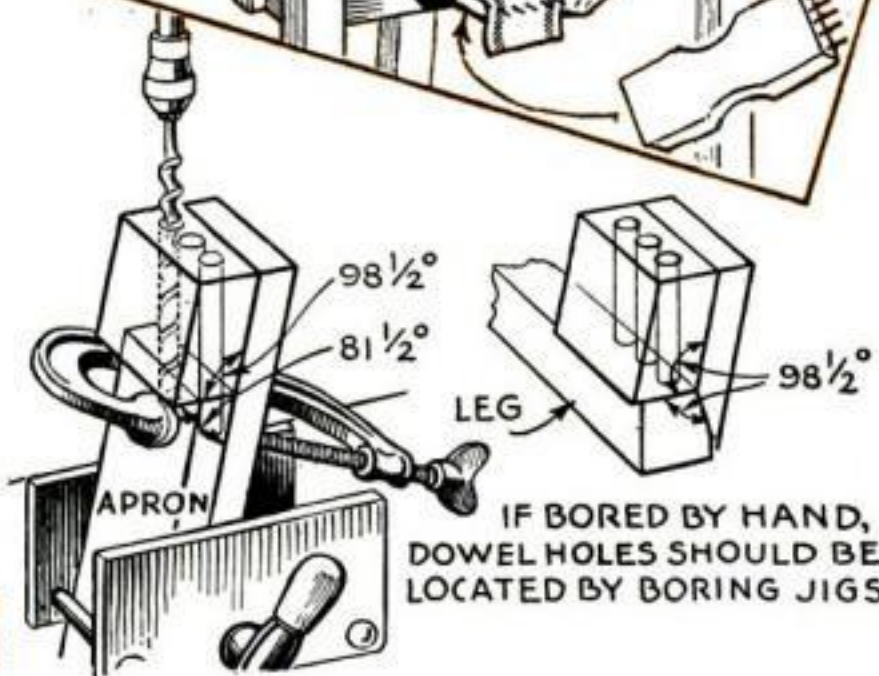
**H**ERE is a comfortable and sturdy armchair to go with the eighteenth-century secretary published last month (P. S. M., Apr. '40, p. 140). The design can also be used without the arms for making dining-room chairs. The rear legs with their cross members should be fitted and glued up first; next the two front legs with the front apron. The fore-and-aft members should then be individually fitted, the frame glued, and the arms added. Upholstering the seat as shown is the final step.



## LIST OF MATERIALS

No. Pc.	Description	T.	W.	L.
2	Rear legs (r. and l.)	1 5/8	4 1/2	36 1/2
2	Front legs (r. and l.)	1 1/2	1 1/2	17
1	Top slat	1 1/16	3	20 3/4
3	Slats—A, B, C*	3/4	2 1/2	16 3/4
1	Seat—front apron	7/8	2 3/4	18
1	Seat—back apron	7/8	2 3/4	12 7/8
2	Seat—side aprons	7/8	2 3/4	15 1/2
1	Cross stretcher*	3/4	1 7/16	18 1/2
1	Back stretcher*	3/4	1 7/16	12 1/2
2	Side stretchers*	3/4	1 7/16	18
2	Arms	1 1/8	3 1/2	14 3/4
2	Arm posts	1 1/2	3	11 3/4
4	Corner blocks	7/8	4	4

Note: All dimensions are given in inches. Parts marked with an asterisk (\*) should be cut to fit, the sizes given being only approximate.





A curiously cut front board with many square holes around the edges conceals the nest box



## Ultramodern Nest Box Mounted on Trellis

FOR use with trellises, pergolas, and ornamental wooden fences, this house for bluebirds or swallows is definitely modern in design. The nest box itself is a 6" cube, outside measurements, and it is placed with one

edge up. The front board is cut out as shown. It has a  $1\frac{1}{2}$ " square hole for a door and other holes of various sizes beyond the edges of the cube, all repeating the square shape.—H. F. S.

## Stick of Belt Dressing Seals Pruned Trees



WHEN you are obliged to cut large limbs from fruit or shade trees and no other suitable compound is at hand to seal the wounds, ordinary stick belt dressing will do the work. Rub it in and lap it well over the sides.



## How to Hide Screw Heads

ROUNDHEAD screws used for bathroom fixtures often become unsightly or have burred slots that catch in wash cloths and towels. Substitute flathead screws,

drill a hole in the center of each, and insert a roundhead upholstery tack, either white or colored.—G. B.

## Paintbrushes Preserved in Dustproof Container

A ONE-GALLON size oil can of the type illustrated makes an excellent and inexpensive container for suspending paintbrushes in a suitable liquid keeper between jobs. The can is cut off about 3" from the top, and a 1" wide strip of tin is soldered to the upper part to form a lid. The brushes are suspended by drilling holes in the handles and hanging them on finishing nails driven in a 1" by 1" strip of wood that is nailed inside the can.

The liquid keeper recommended for paintbrushes is a mixture of equal parts of pure turpentine and raw linseed oil, or equal parts of pine oil and raw linseed oil. Varnish brushes are best preserved in a mixture of half slow-drying varnish and half pure turpentine. The mixture should fill the can halfway up on the metal ferrule of the brushes.





# MINIATURE Police Emergency Car

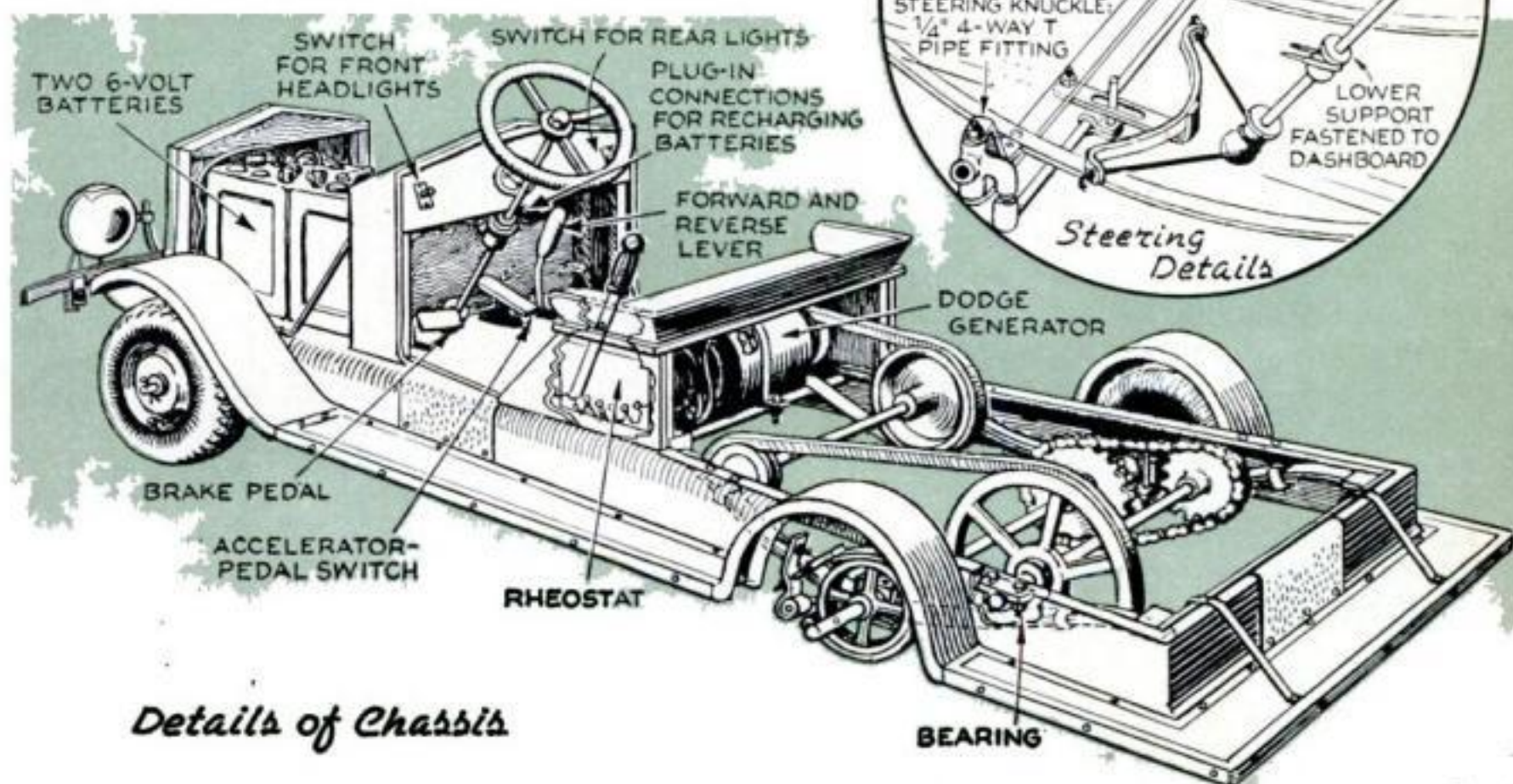
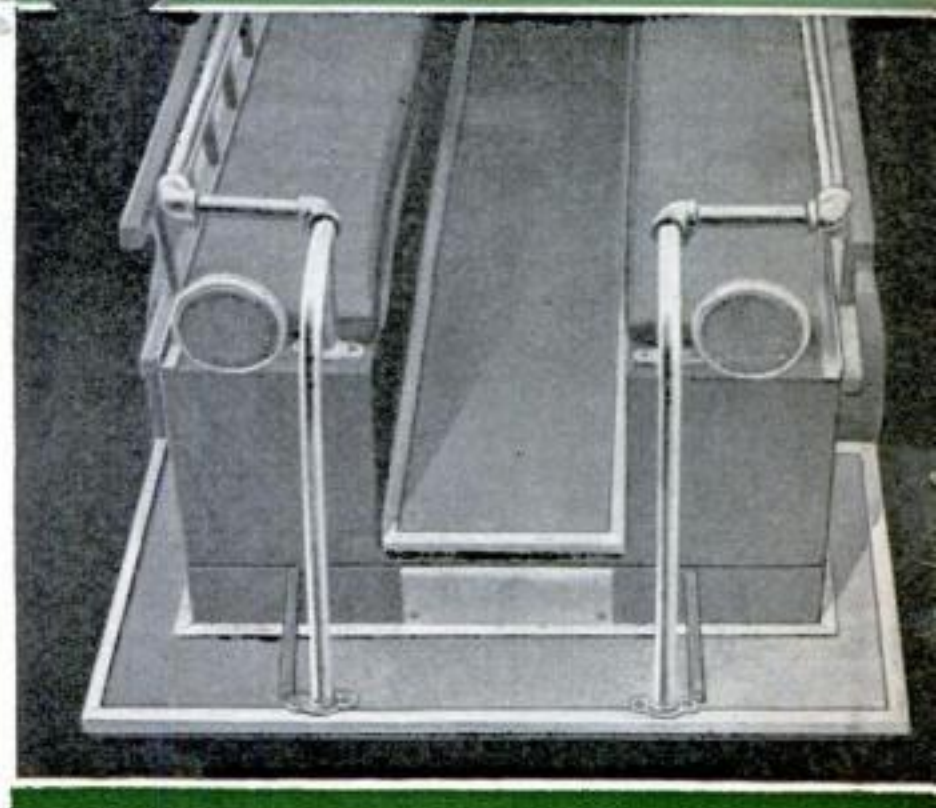
## BUILT FROM OLD AUTO PARTS

A foolproof five-speed drive enables a child to run the truck with safety

**C**OMPOSED mainly of junked automobile parts and miscellaneous stock fittings, this miniature police emergency car was designed and built by O. J. Herbermann, of Flushing, N. Y., for his six-year-old son, Richard. The auto is 7' long overall, weighs approximately 250 lb., and is even capable of towing a full-size automobile.

A Dodge 12-volt starting motor mounted under the seat and operating on two 6-volt storage batteries supplies the power. The batteries are carried under the hood. The power is reduced by a series of V-belt pulleys and chain gearing in a ratio of 15 to 1. The accelerator pedal is merely a switch that is on when depressed and off when no pressure is applied. Five speeds are available by means of a lever attached to a homemade rheostat. The latter consists of binding posts mounted on a fiber board with short lengths of No. 16 nichrome wire as connections. A separate lever reverses the motor when reverse speed is desired.

The frame is made of 1" angle iron, the body of galvanized iron and  $\frac{1}{4}$ " plywood. Handrails on the back superstructure, which can be removed, are formed from  $\frac{1}{2}$ " chrome-plated brass water pipe. A special steering arrangement had to be devised as shown in the circle to maneuver the machine. The steering post is  $\frac{1}{2}$ " cold-rolled steel 22" long. Standard 10" tires fit on the wheels.



*Details of Chassis*

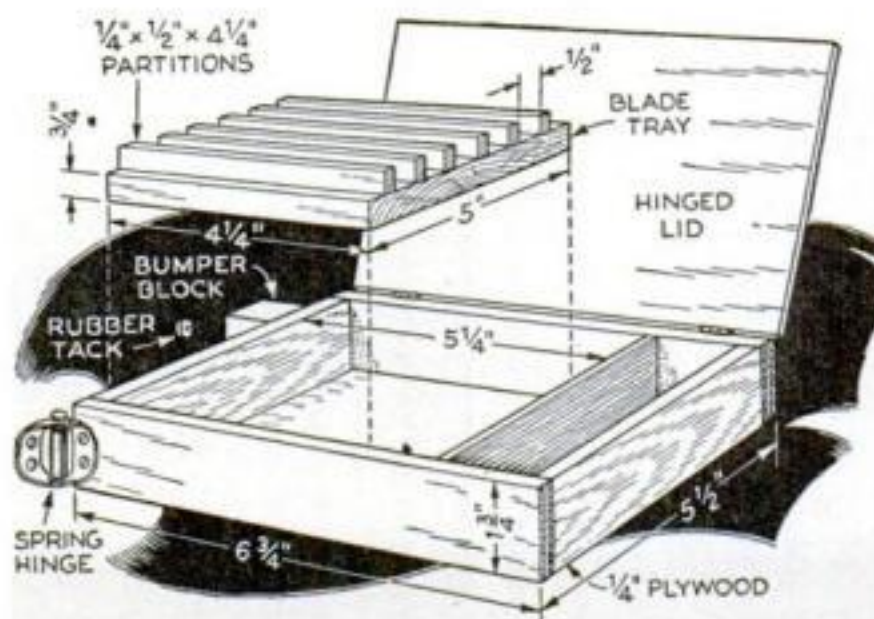


## Box under Scroll Saw Keeps Blades Handy



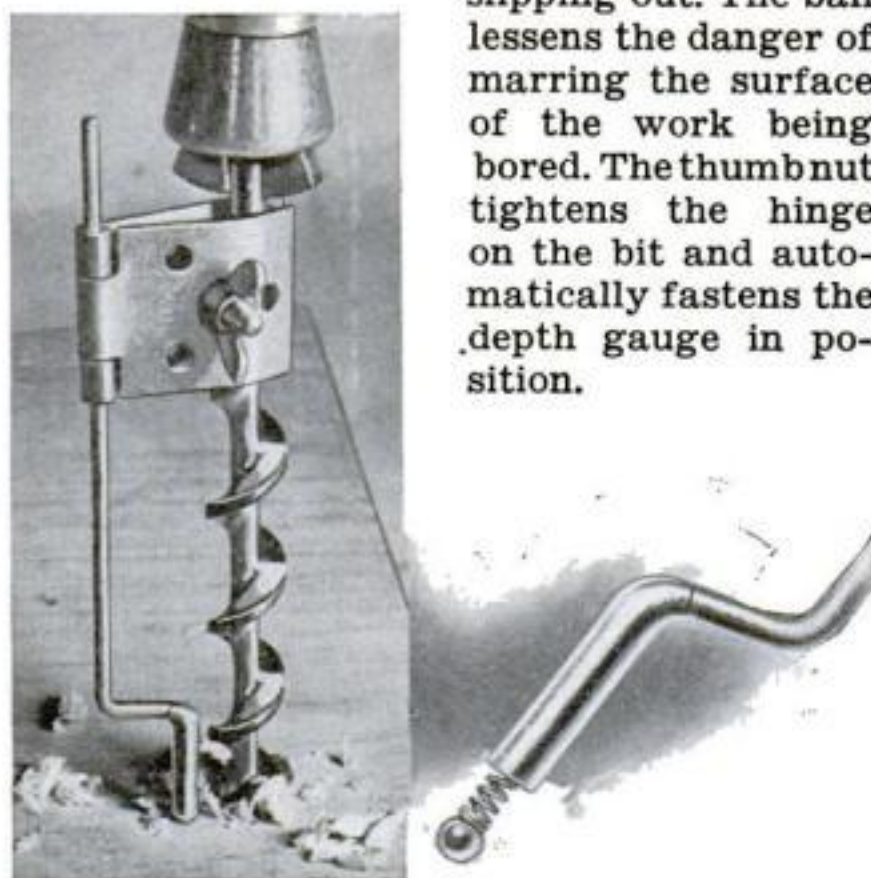
When the lid is closed, the box automatically swings underneath the stand and out of sight

A CONVENIENT place to keep scroll-saw accessories such as blades, chucks, and wrenches is in a small box of  $\frac{1}{4}$ " plywood mounted underneath the machine as shown. The hinged lid, when raised, rests against the frame of the stand, thus holding the box in position for easy access. At other times the box swings underneath the scroll saw by reason of the spring hinge. Attach a small block to the box to act as a bumper against the opposite leg of the stand.—H. M.

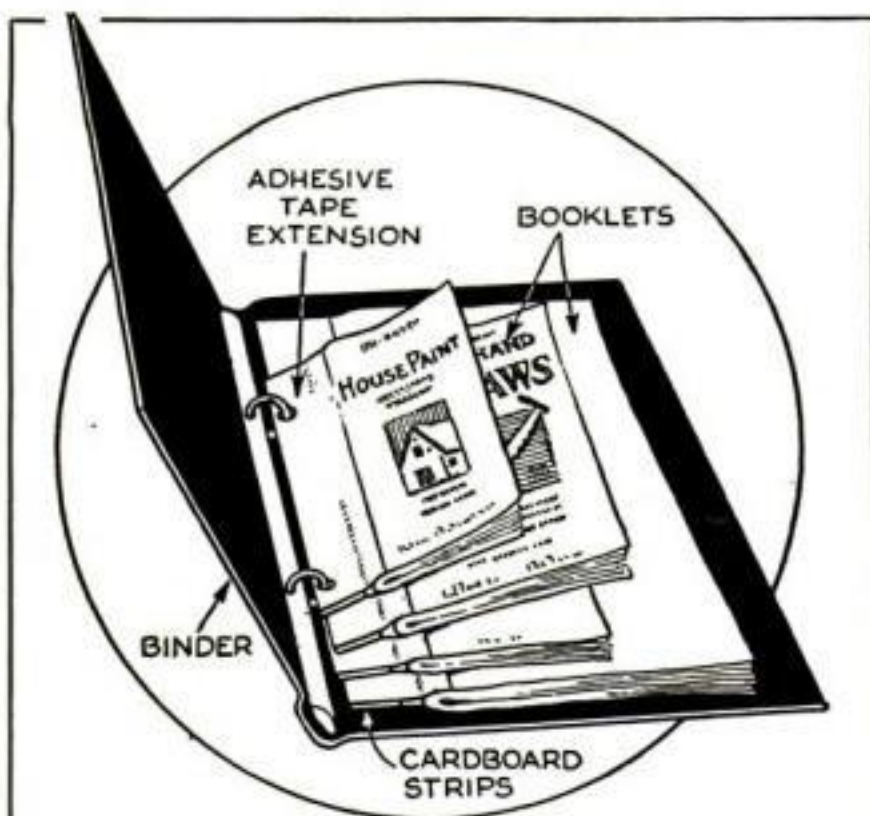


## Depth Gauge Is Clamped on Bit with Hinge

A SMALL hinge with a bolt and thumb nut may be used to fasten a depth gauge on an auger bit as illustrated below. The gauge itself is bent to shape from 8-gauge wire. The tip is inserted in a short piece of tubing, in which a small spring and a  $\frac{3}{16}$ " ball bearing is placed. The end of the tubing is tapped to close the opening enough to prevent the ball from slipping out. The ball lessens the danger of marring the surface of the work being bored. The thumbnut tightens the hinge on the bit and automatically fastens the depth gauge in position.



POPULAR SCIENCE



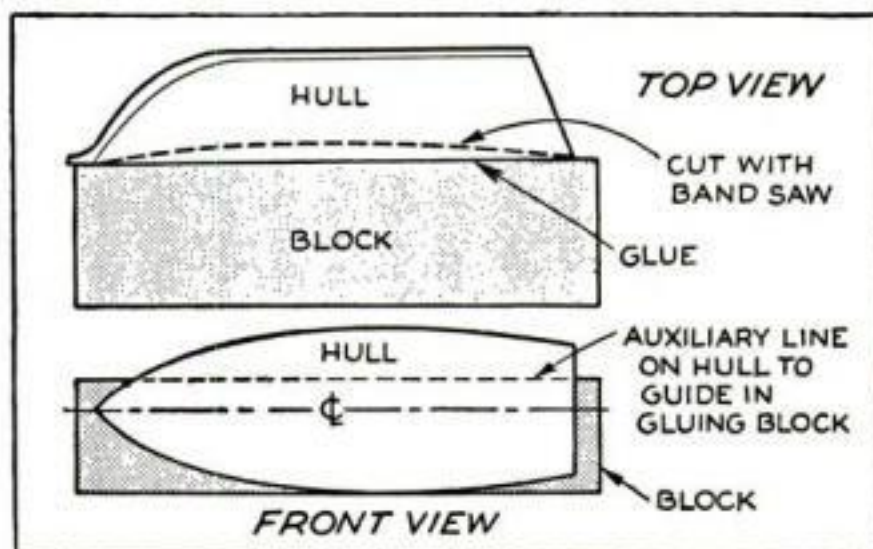
## Reference Booklets Held in Loose-Leaf Binder

VALUABLE information, recipes, formulas, and other data worth preserving are often contained in booklets of varying sizes. If their bound edges are extended with adhesive tape as shown, the booklets may be readily kept in a conventional loose-leaf album. Strips of cardboard are embedded between the two layers of tape to stiffen the extensions.



## Band-Sawing Deck Curves of Ship-Model Hulls

AFTER the hull of a ship model has been carved, the sheer curve on the deck line can be band-sawed or jig-sawed accurately by gluing a block to the hull. The block supports the hull at right angles.



## Grass Catcher Used as Shop Dust Pan

A LARGE dust pan for use in sweeping up the shop can be made from the discarded grass catcher of a lawn mower. Rivet a strip of sheet metal or a piece of thin plywood with a beveled edge to the sheet-iron bottom to bridge the wire front and make it easy to sweep trash into the container.—E. L.

## Wire Cuts Up Lumps in Small Funnel

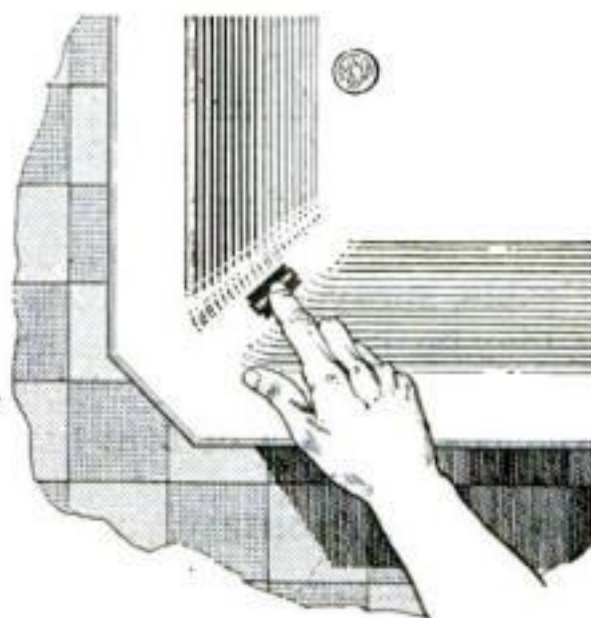
WHEN photographic chemicals are poured through a small funnel to mix solutions in quantity, a common annoyance and cause of delay is the clogging of the funnel because of lumps in the chemicals.

A good way of avoiding this is to insert a piece of wire through the funnel beforehand, and when a lump stops the flow, break it up by turning the wire in a spiral fashion. Bend a hook in the end of the wire so it can be hooked over the rim of the funnel and left hanging there when the funnel is not in use.—L. H.



## Razor Blades Sharpened on Tub

DULL safety-razor blades of the thin, flexible wafer type may be given a sharp edge by rubbing them gently with a circular motion on the rounded inside corner of a porcelain bathtub.



Hold the blade by one finger in a vertical position against the porcelain as shown. The drawing is a view as if looking down. It will be found that this method gives better results than rubbing the blade inside a glass tumbler in the way so commonly practiced. Besides, the tub is always at hand.—KENNETH L. WILSON.





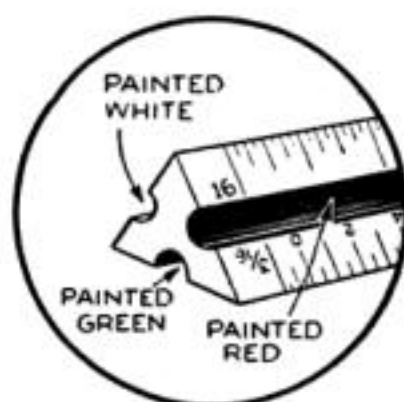
Drum and rack are swung up together by strong rope and a lever

## One Man Lifts Oil Drum into a Storage Rack

CONFRONTED with the job of lifting a drum of oil into a rack, one man who usually has to work by himself solved it by the method illustrated. The drum was laid flat on the ground and the usual sawbuck type rack laid down beside it. A rope and lever were then used to swing drum and rack up together. Because of the strain on the legs of the rack, a cross brace had to be added as indicated.—JAMES J. WENNER.

## Sponge Rubber Protects Bottom of Quiver

A PIECE cut from an old sponge-rubber bath mat and fitted in the bottom of an archer's quiver as shown at the right will eliminate the scratching and cutting of the leather by the hunting or target points, and also do away with most of the rattle of the arrows on the bottom of the quiver.—ELWOOD LINDELL.



## Scale Grooves Painted for Identification

WHEN an architect's triangular scale is used, much time is ordinarily wasted in looking for the edge with the desired graduations. By painting the three semicircular grooves on the scale in three different colors, such as red, green, and yellow, the edge with the wanted markings can be located at a glance. Just keep in mind the color of the scale you desire to use.—CARL SORENSON.

## MAPLE STAINS

[PAINTING]

All maple finishes should be clear, thin, and transparent. Sand all wood clean with 4/0 garnet finishing paper; sponge with clean water, but avoid touching with the hands; dry; sand clean with 4/0 or 6/0 paper. Then use one of the following water stains. The colors mentioned are standard water-soluble wood stains sold in powder form. If these cannot readily be obtained, ordinary household dyes of corresponding colors will serve as well, but select dyes intended for dyeing silk, not cotton.

*Honey Maple.* Canary yellow, concentrated, 14 grams; orange, 20 grams; hot water, 1 gallon.

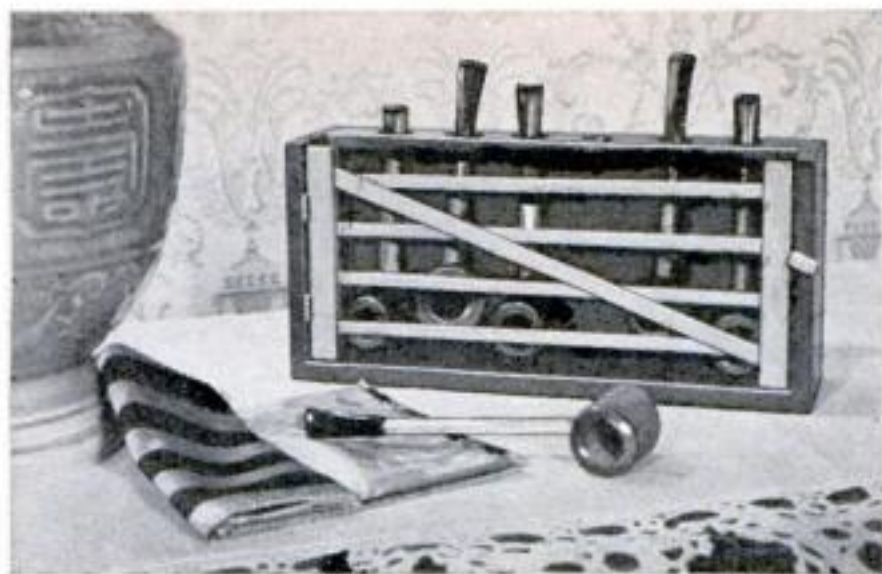
*Amber Maple.* Add to the preceding formula 5 to 10 grams of jet black.

*Cottage Maple.* Add to the amber-maple formula, 5 grams of scarlet.

*Note:* Wherever practicable, sprayed-lacquer finishes are ideal on maple. An excellent finish, however, may be obtained with a sealer coat of thinned brushing lacquer applied over the stain; dried; sanded with 6/0 garnet finishing paper, followed by two well-brushed-out coats of four-hour floor varnish, dried and rubbed dull.

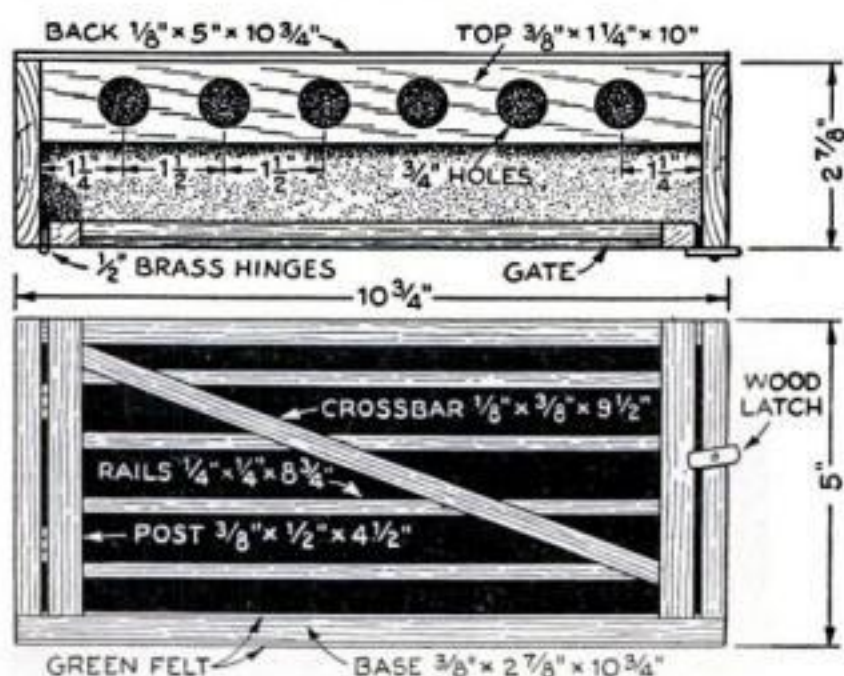
POPULAR SCIENCE MONTHLY SHOP DATA FILE





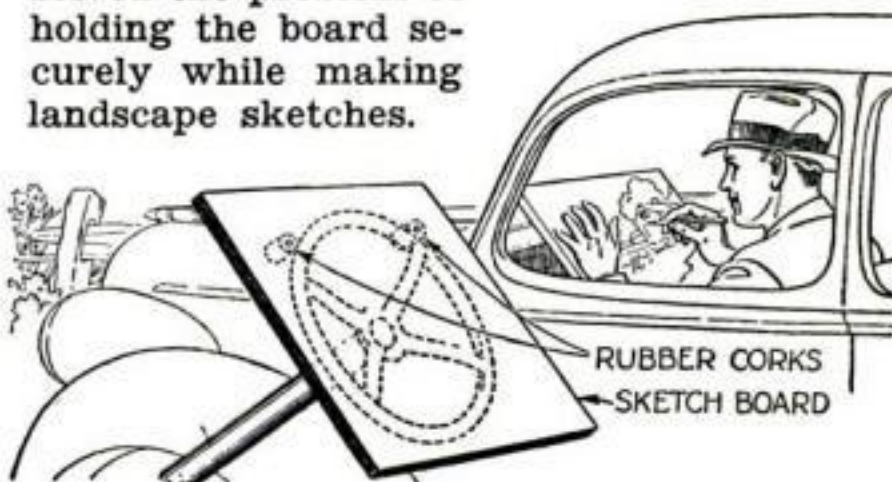
## Miniature Country Gate Keeps Pipes in Rack

A MINIATURE country gate safeguards the half-dozen pipes in this practical rack, which was made of wood taken from cheese boxes. The parts should be cut to size, sanded smooth, and assembled with glue and small brads. The gate, however, is merely glued to prevent splitting the small parts. A  $\frac{3}{4}$ " drill will provide holes sufficiently large to admit any ordinary size pipe. Several coats of dark-oak varnish stain were applied to the rack and a single coat of light-oak stain to the gate itself. Where better woods are used, a medium or dark stain is suggested, followed by a polished wax finish. Green felt is glued to the top of the base and to the underside.—ANDREW C. BRUENING.



## Artist Uses Auto Wheel to Brace Sketch Board

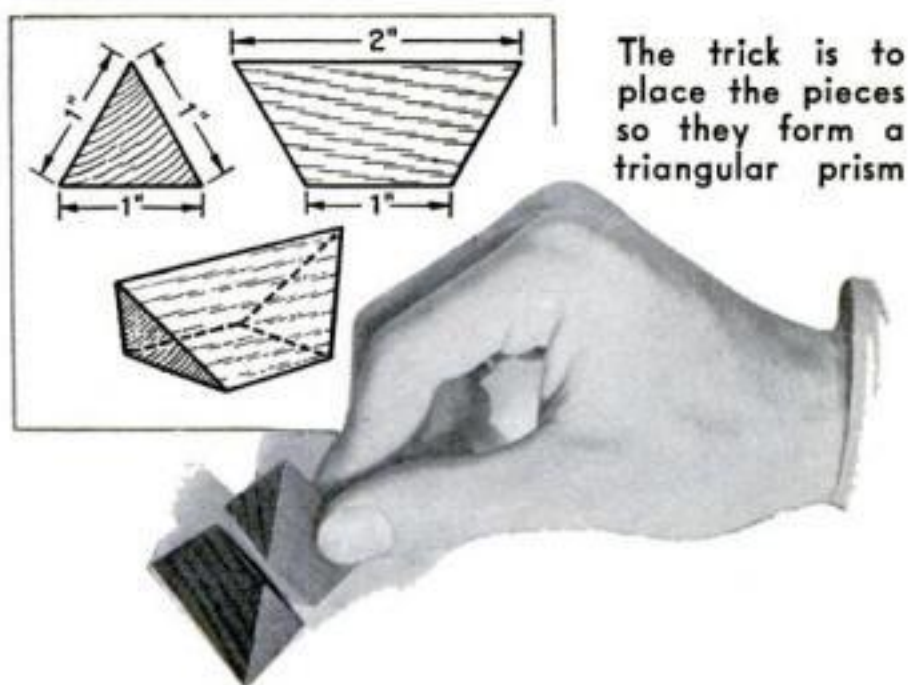
BY ATTACHING a couple of rubber bottle stoppers to the back of his drawing board so that they would rest snugly against the rim of the steering wheel of his car, one artist solved the problem of holding the board securely while making landscape sketches.



Corks brace the board against the steering wheel

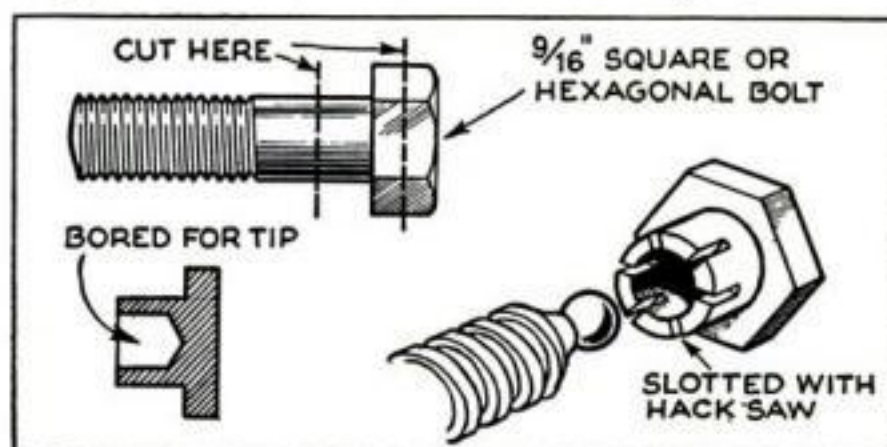
## Two-Piece Block Puzzle Is Tricky to Solve

A SIMPLE yet somewhat confusing block puzzle may be made by planing a stick of suitable material into the form of a 1" triangular prism about 6" long and from this cutting two pieces to the dimensions given. The two pieces are to be placed together so as to form a three-sided pyramid, and this is done as in the accompanying photo.—A. L. S.

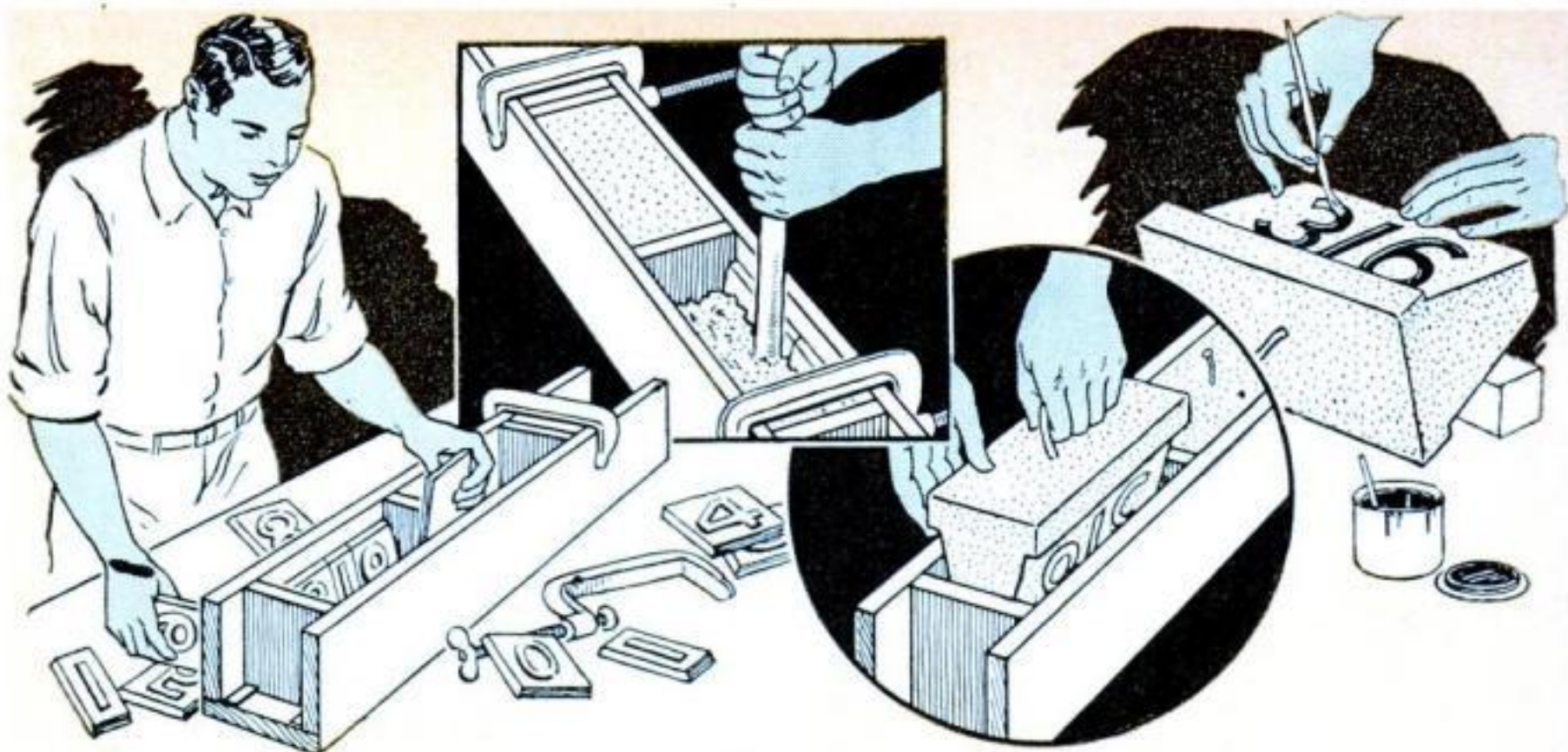


## Replacing Lost Swivel Tips on Old C-Clamps

C-CLAMPS sometimes lose their swivel tips, but are in good condition otherwise. They can be repaired as illustrated in the sketches at the right by using  $\frac{9}{16}$ " square or hexagonal bolts. After the tip has been sawed and drilled as shown and the slots cut with a hack saw, it is clamped in the vise and the segments are bent into place about the ball point of the clamp with a hammer and punch.—XURY R. SETTLE.







## CONCRETE HOUSE NUMBERS

**H**OW many times have you wasted time and suffered annoyance in trying to find a certain house number on a dark night? House numbers are often none too conspicuous even in daylight, and they are impossible to see at night unless you go right up to them or use a flash light.

Various expedients have been suggested to overcome this difficulty. Illuminated numbers are sometimes used, but in many localities it would be necessary to hunt for many blocks to find a single one. In certain cities the numbers are painted on the curb, but these are easily overlooked and become indistinct unless repainted at intervals.

One of the best ways of displaying house numbers is by using concrete blocks like that illustrated. It has recessed numbers painted black, which are readable half a block away. You can easily make similar ones for yourself and also for sale, if you wish. The material in each block costs about five cents, yet the numbers sell readily for \$1 or \$1.25. All you need do is to put out a few samples at stores around town and watch the orders come in.

For the mold, nail together three pieces 1" by 6" by 48" and two pieces  $\frac{1}{4}$ " by  $\frac{3}{4}$ " by 48" as shown (A, A, B, and E.). Cut four pieces of  $\frac{1}{2}$ " plywood into strips 4 $\frac{1}{2}$ "



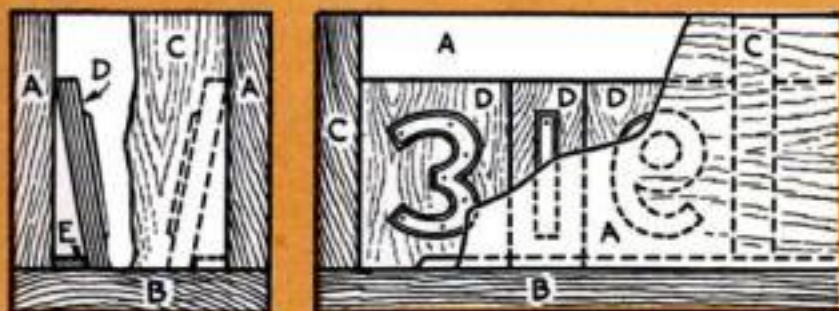
wide and 48" long, as at D, the saw table being at an 80-deg. angle. Then saw these strips into thirty-six blocks 3 $\frac{1}{2}$ " wide and four blocks 1 $\frac{3}{4}$ " wide. (All numbers except 1 are mounted on the 3 $\frac{1}{2}$ " blocks.)

Now make cardboard patterns of the numbers and trace them on  $\frac{1}{8}$ " pressed composition wood of tempered quality—about four of each to start with. Set the jig-saw table at a 50-deg. angle and saw out the numbers. Mount them on the plywood blocks. Note that the numbers must be mounted as shown and put in the mold upside down and backwards.

Blocks C, to separate the sets of number blocks, are made as indicated. Be sure to



15342e780



How the number blocks are set up in the mold, and a wooden clamp to keep it from spreading

By  
**STEPHEN H. POGUE**

cut them out at the bottom for strips *E* so they will fit tight against the bottom *B*. Two 6" C-clamps are needed, or a wooden wedge clamp made as at *G*, to keep the mold from spreading when the cement is tamped down. In setting up the molds, it is a good idea to check the numbers with a mirror to be sure they will read correctly. Oil the inside of the mold with heavy motor oil.

Mix the concrete in the proportions of about 2½ quarts of sand and 1 quart of cement for each block. The dry ingredients should be mixed thoroughly before the water is added, and the mixture should be stiff. Put it in the mold about a pint at a time and tamp down well. It is necessary to work fast. Insert a bent nail in the block and finish off with a small trowel.

Let the cement dry for about twelve hours, then release the clamps, insert a wedge between *A* and *C*, and lift out each block by the nail. Smooth up the block by brushing on a mixture of cement and water mixed to the consistency of cream, then let it stand for several days until thoroughly dry. Paint with white enamel, and when dry fill in the numbers with black enamel.

Insert a small can in the ground where the number is to be placed, fill it with cement, place the block so the nail centers in the cement, and you have a house number that will last indefinitely.

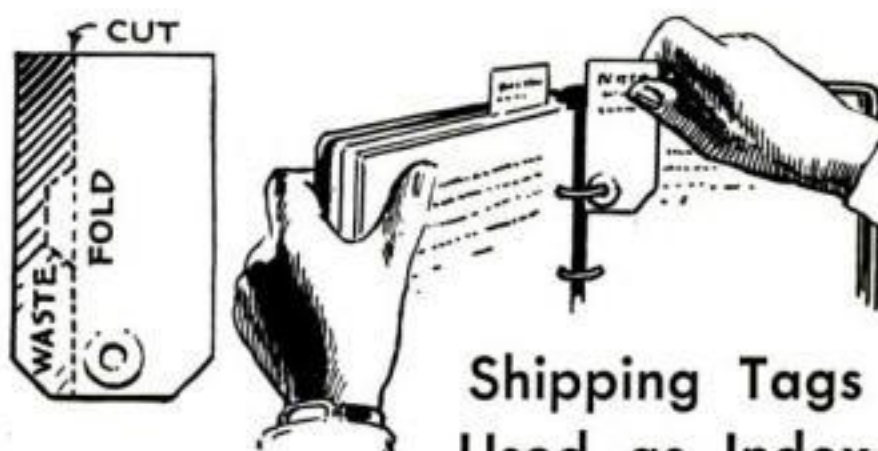
If desired, the blocks may be tinted any color by adding pigment to the mixture. The pigment must be resistant to alkali.

## Soil Tile Carries Water to Roots of Tree

IN DRY seasons the soil is often so parched that any water applied on the surface to water trees does not soak down to the roots. An excellent plan is to dig a hole and set into it a 12" length of soil tile so that the top is slightly higher than the ground. When water is run into the tile from the hose, the moisture goes directly to the roots of the tree or the shrub where it is needed the most.—EMIL PEARSON.



Watering tree roots through a length of tile pipe



Shipping Tags  
Used as Index

DURABLE and economical markers for a loose-leaf shop catalogue, parts-list binder, or notebook may be made by using small shipping tags cut as shown. Leave a small flap on the edge to be folded down for keeping the markers aligned.—A. M. CHESTER.



# KEEPING THE



In sleepily reaching for an alarm clock to shut it off, you may knock it from the table. This won't happen if you replace the feet of the clock with four small rubber suction cups



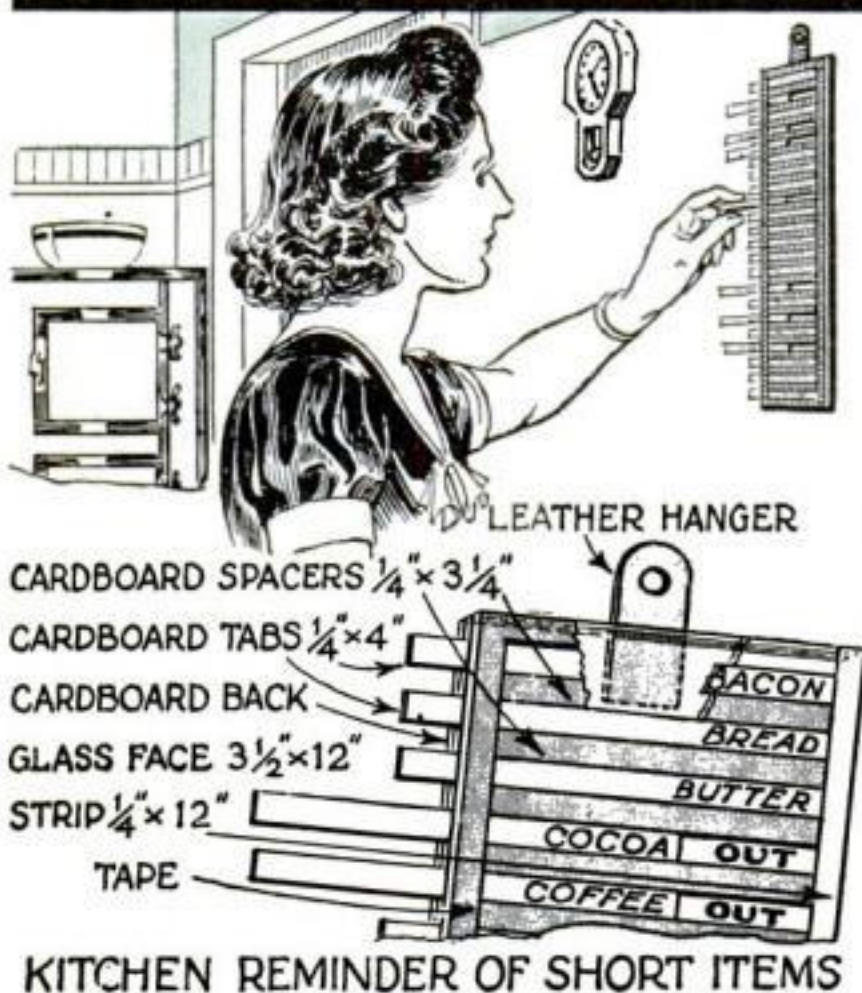
Paste furniture wax or shoe polish is conveniently applied with a small powder puff, which is soft yet easy to hold



When a shoe pinches unbearably, lay a cloth, wrung out in hot water, over the area for several minutes. The warm moisture causes the leather to stretch and eases discomfort



Metal glides, commonly used on the legs of kitchen furniture, are apt to mark the linoleum floor covering quite badly. This can be prevented by cementing felt disks to the glides with thick orange shellac



If a bushel basket is mounted on a 1" by 6" by 18" base by means of a 6" disk so that it will revolve, a garden hose can easily be coiled in it and carried into the cellar, garage, or tool shed



# HOME SHIPSHAPE

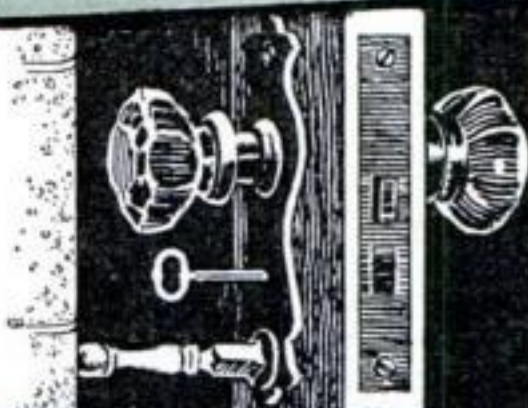


An old glove finger, if slipped over the end of a curtain rod, will keep it from catching in the hem



Plaster of Paris dries so rapidly that it is rather difficult to use for patching. It will remain workable for a longer time if mixed with vinegar instead of water, or water to which some vinegar is added

In a room with tile walls and floors, it is often easier to fasten a doorstop to the door itself, usually at the bottom. In some cases, however, it is better placed as shown because there is no danger of kicking it



Inexpensive hand sprayers of the type sold for use with insect sprays can be made more efficient by drilling or punching a small hole in the cap to overcome the vacuum formed in the container



ADHESIVE  
TAPE

Pictures hung from a single hook will not shift so readily if the center portion of the wire is bound with adhesive tape



The semiannual chore of putting up and removing window screens can be done with less effort if the upstairs screens are not taken inside, but hoisted by means of a light rope to one end of which a wire hook has been tied



## Four-Wheel Creeper Makes Weeding Easy

STOOPING to weed a large garden or lawn is very tiring, especially for the elderly, but it can be avoided by making a four-wheeled creeper like the one illustrated. I used two bicycle wheels with deflated tires, two scooter wheels, two steel rods 30" long for axles, two lengths of  $\frac{1}{2}$ " gas pipe to reinforce the axles, and an old ironing board. Each axle is fastened to the board with two U-bolts.

For weeding, my favorite "digger" is a steel table knife with a "V" ground in the end on the edge of an emery wheel.—S. L. STOVER.

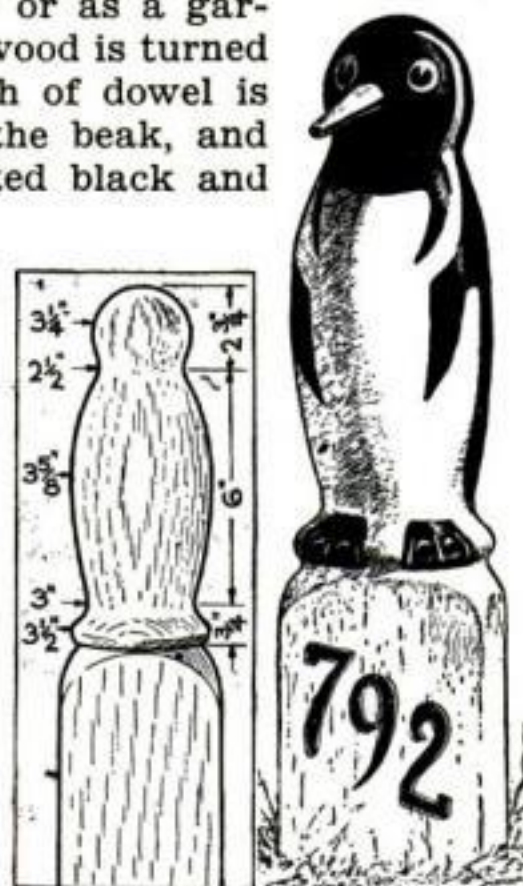


Two bicycle wheels, two scooter wheels, and an old ironing board form the principal parts of this creeper for weeding

## Penguin Lawn Ornament Turned from Wood

A LEFT-OVER block of wood about 4" square and 2' in length or longer, can be converted easily into a lawn ornament for displaying the house number or as a garden marker. The wood is turned as shown, a length of dowel is inserted to form the beak, and the whole is painted black and white with yellow beak to resemble a penguin.

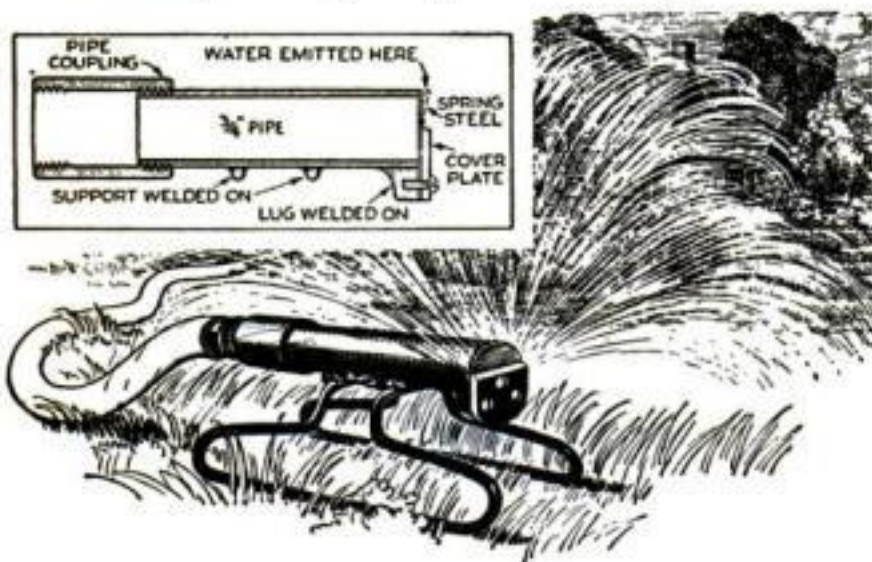
Suitable dimensions are given at the right. The writer placed the penguin at the head of some steps made of sharp-edged marble slabs so that youngsters would be less likely to fall and hurt themselves.—R. E. TILLBERG.



## Ends of Toothpicks Used as Phonograph Needles

WHEN you have used your last phonograph needle late at night and can't go out to buy a new supply, try using the ends of round, polished toothpicks. They will give a soft but satisfactory tone without any scratchy noise. If rather blunt, the points can be sharpened with a fine file or sandpaper.—WILLIAM SWALLOW.

## Spring Lip on Sprinkler Keeps Spray Uniform



BECAUSE city water pressure sometimes varies, the householder may find that the lawn sprinkler he has set to cover a certain area either fails to water the entire area or sprays too far over the sidewalk or through an open window. This is prevented in the sprinkler shown by a lip of spring bronze or steel. The sprinkler is a  $\frac{3}{4}$ " pipe with a coupling welded on, and a wire base. The lip, kept in place by a plate-steel cap which is screwed on the pipe itself, springs outward as the pressure increases, keeping the shape of the spray the same.—E. J. TANGERMANN.



# FUN WITH YOUR BIKE

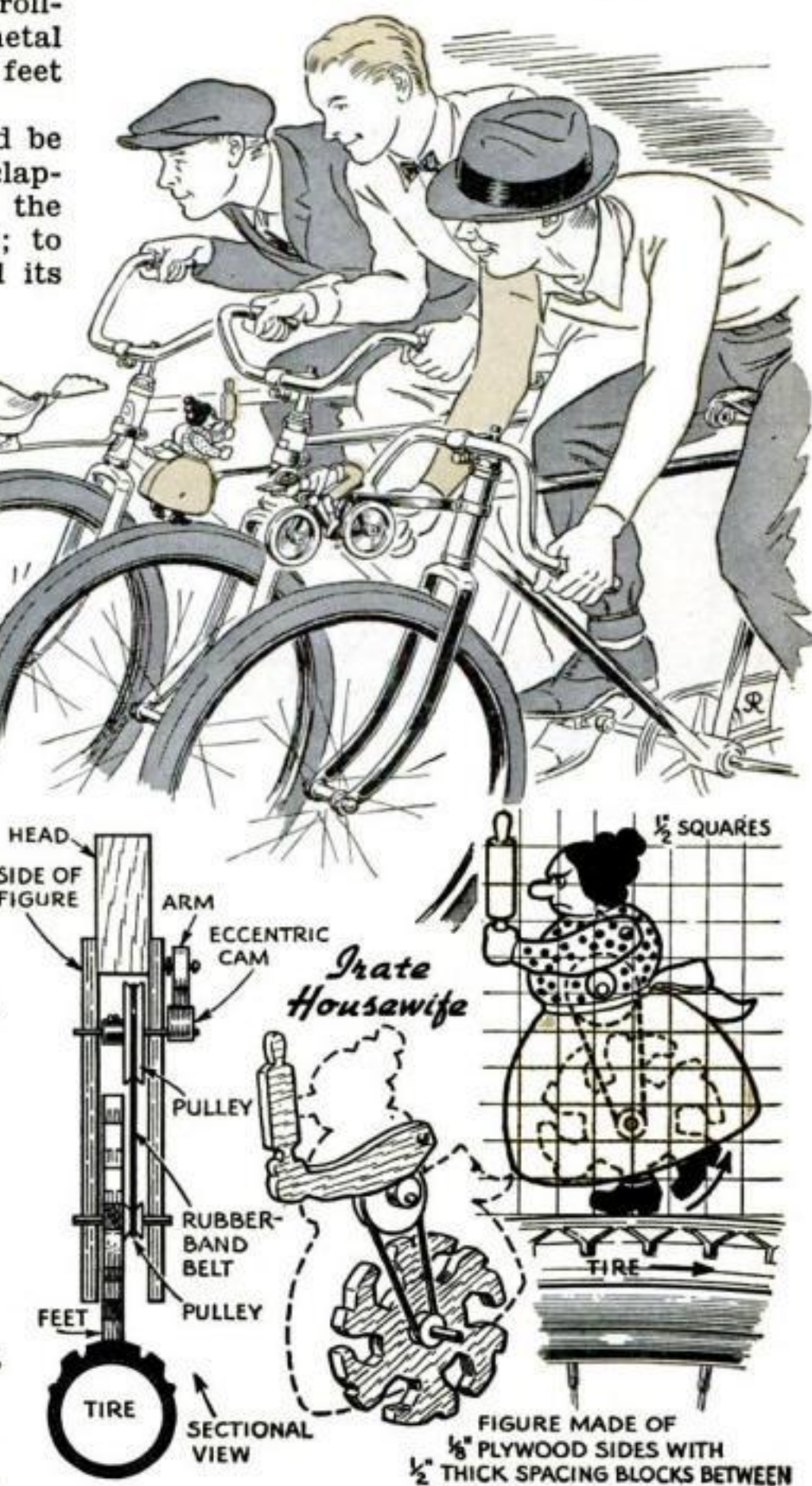
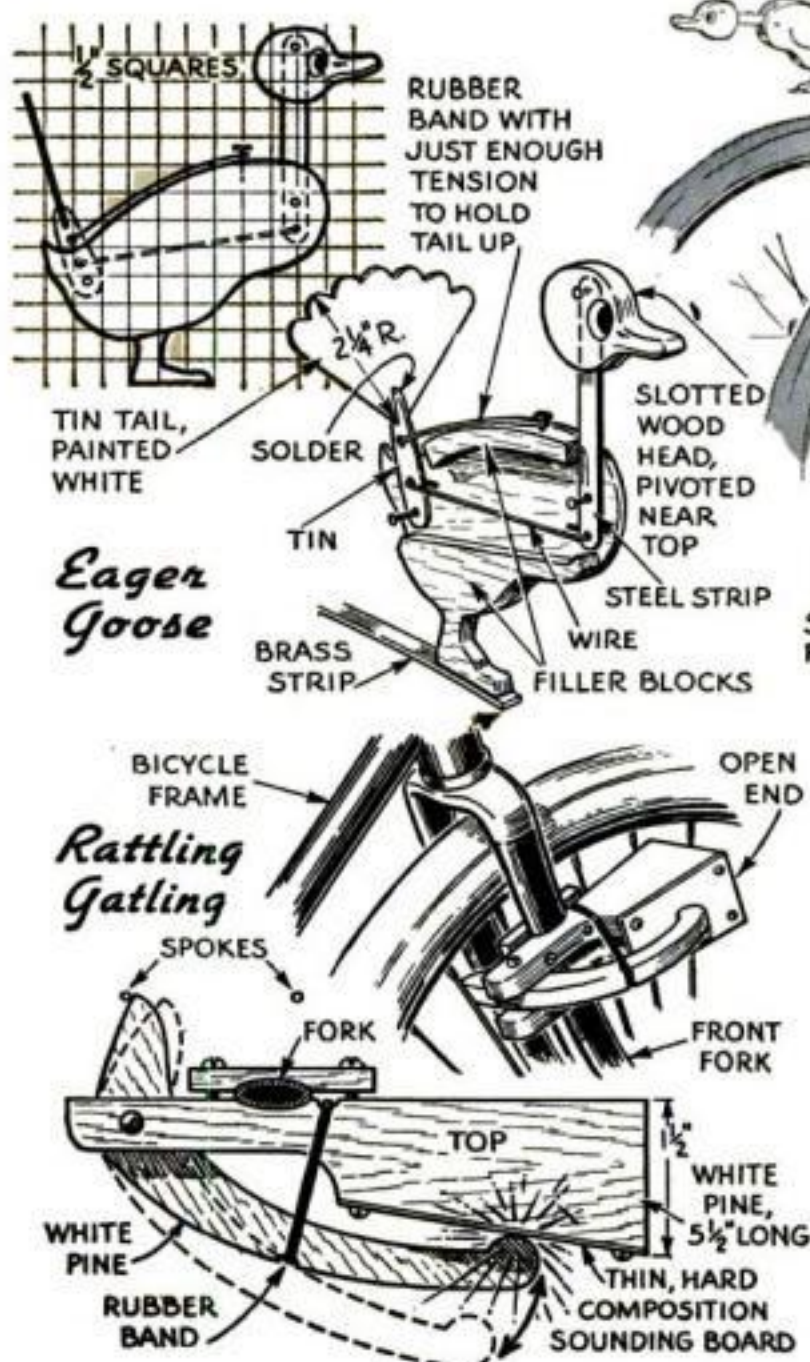
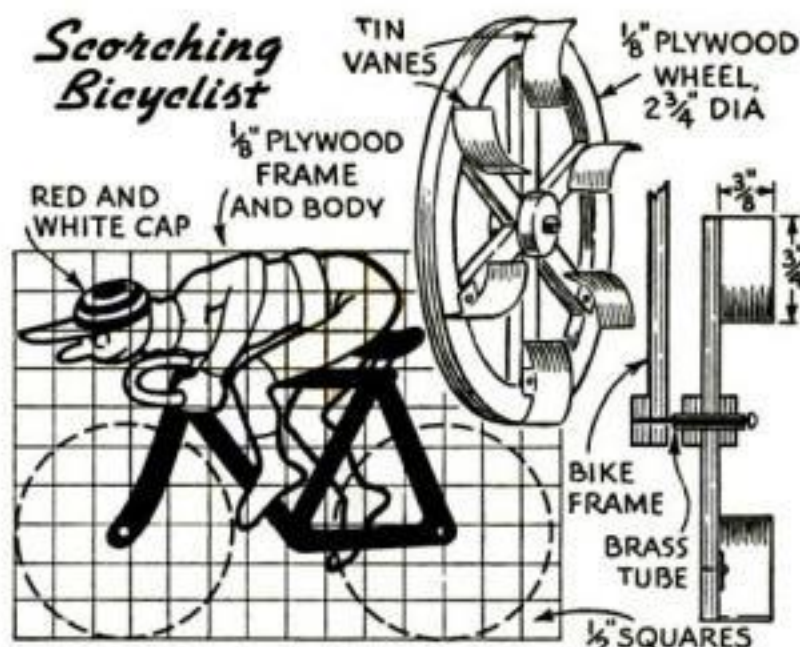
**A**NIMATED figures attached to the front of your bicycle will attract a lot of attention. Three types are illustrated, as well as a machine-gun noise maker.

**Eager Goose.** As soon as the breeze strikes its tail, the goose flattens out and stretches its neck as though heading for new feeding grounds. The tail is connected to the neck by means of a wire link.

**Scorching Bicyclist.** Small curved vanes of tin or aluminum turn the wheels. Scroll-saw the wheels and figure from thin plywood. The wheels have brass tube bearings to reduce friction.

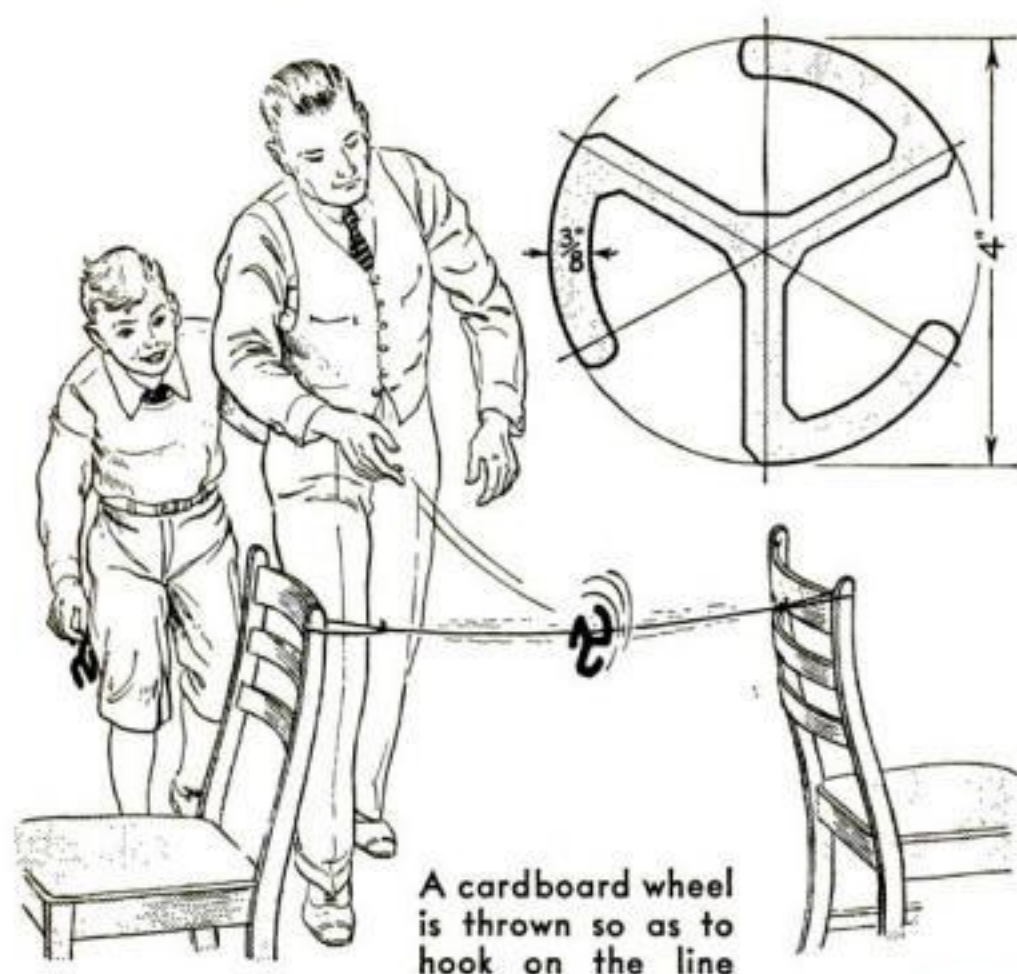
**Irate Housewife.** This is an easy scroll-saw job, and should be mounted on a metal strip with some spring to it, to hold the feet lightly against the front tire.

**Rattling Gatling.** The clapper should be made of lightweight wood. Wedge the clapper back when riding silently. Use the noise maker only on special occasions; to keep it working all the time will spoil its effectiveness and quickly wear it out.





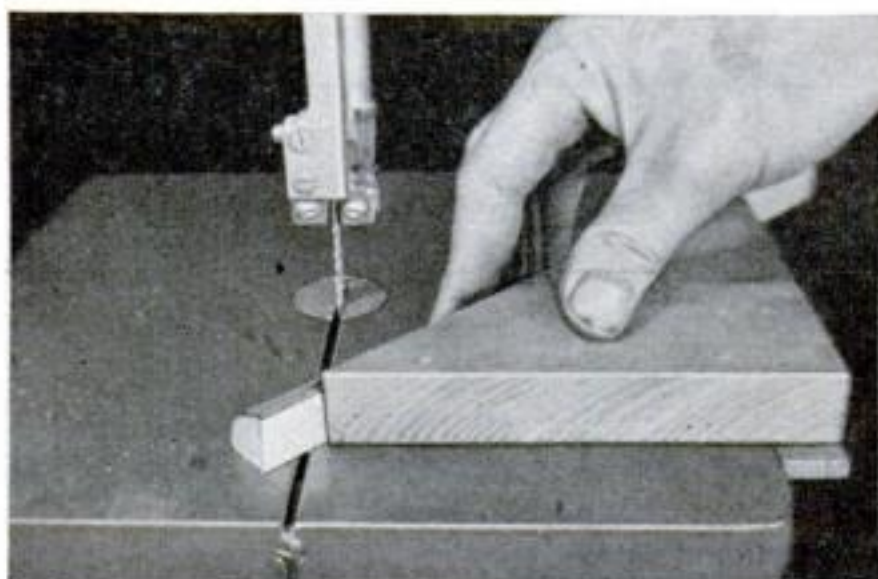
# Amusing New Toss Game Baffles the Contestants



ALTHOUGH this new toss game is called "Dangle," it might well be named "Try Again" because it is not as easy as it looks. The object is to stand two feet or more from the string and toss the cardboard dangle or wheel so that it will catch and stay on the string. Each player is allowed three tries, and after ten rounds the score is added. What makes it more difficult is the fact that the cord, which should be about 36" long, is supported at each end by light rubber bands. Sometimes when the dangle is apparently well hooked on the string, the contracting bands throw it off. The dangles can be cut out with a razor blade from any stiff, colored cardboard or from two pieces of different colors glued together, or they may be colored with paints or crayons.—DONALD W. CLARK.

## Wooden Miter Gauge for Band-Saw Table

WHEN moldings or odd-shaped parts have to be cut to a 45-deg. angle on the band saw and it cannot conveniently be done by tilting the table, a guide may be made as shown. Cut a piece of wood on a 45-deg. angle and nail a strip of wood along one edge to slide against the edge of the table as the work is pushed past the blade.



## A Timesaving Way to File Circular-Saw Blades



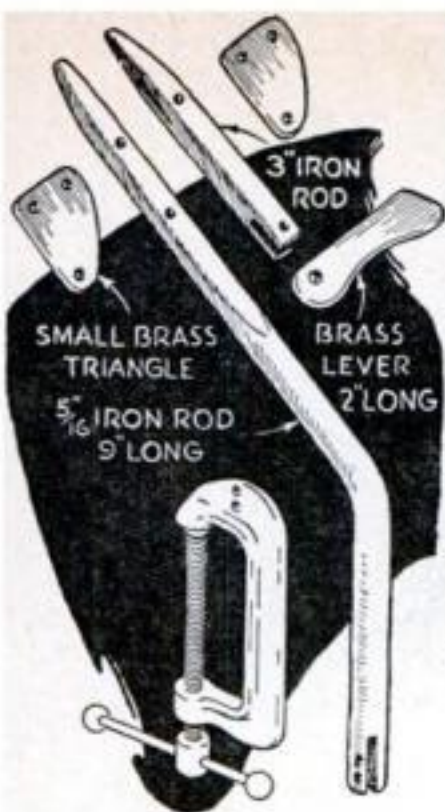
FOR the woodworker who wishes occasionally to touch up or file the teeth of a circular-saw blade, a filing block of the type illustrated will enable him to do so without removing the blade from the machine. The block is made in two sections, joined with a small hinge. The larger section is clamped to the saw bed, and the smaller one is fitted with a dowel that engages the gullets of the teeth and prevents the saw from moving while the teeth are filed.—H. R. H.

## Lifting Prints from Ferrotypes

TO LIFT the corners of glossy prints from ferrotypes plates without splitting the prints or scratching the plates, use a small, flexible strip cut from a discarded film from a film pack.







Pressure on the cam lever tightens the vise jaws so they grip the hook securely

## Low-Cost Vise Holds Hooks for Tying Casting Flies

THE most essential part of fly-tying equipment is a vise to hold the hook. The one illustrated requires a 9" length of 5/16" iron rod. With a hack saw cut a slit in one end about 1/2" deep. Heat the rod and flatten the opposite end so that the flat side is parallel to the slit. Five inches from the flattened end, bend the rod to an angle of 120 deg. When the rod is cool, grind it to a taper on the other three sides of the flattened end. Fit a small C-clamp into the slit, drill holes through rod and clamp, and fasten with rivets.

To complete the head of the vise another piece of iron rod 3" long is ground to a taper on one end, and a slit is cut in the other. A brass lever 2" long with a hole drilled slightly off center is riveted into this slit so as to form a sort of cam to tighten the vise jaws. Now attach this rod to the upright with triangular brass pieces as shown.—HOWARD HOADLEY.

## Photo-Reflector Clamp Grips Small Objects for Gluing



FOR holding small objects together while being glued, the spring clamp of a photo-flood reflector serves nicely in an emergency, as shown at the left. Not only does it exert considerable pressure, but the rubber facings on the jaws will prevent marring the work.—W. C. L.

## Leg Supports Blowtorch While Being Filled

ALWAYS at hand when needed, this folding stand holds a blowtorch while the tank is being filled. Note that the corners of the sheet-metal clamp are bent outward and shaped to form small ears for the leg to snap over, so that it remains firmly either up or down as required. It is well to leave extra metal at the corners for this until the stand has been assembled and the exact positions of the ears can be determined. A compression spring placed over the rod between the two branches of the clamp gives added assurance that the stand will stay fixed in either position.

The stand's dimensions, of course, are governed by the particular torch to which the stand is being fitted, so are not given in the sketch below.—R. A. CARRIER, JR.



## Hook on Rule Reënforced

THE spring that winds a flexible steel rule into its case is so strong that it sometimes tears loose the hook at the end of the rule. To prevent this, solder the hook onto a new tape, thus reënforcing the small rivets. At the same time also solder the seam on the edge of the case as this will prevent it from being easily crushed.—ARNE O. SALONEN.





# Installing Electric Clocks

Modern self-starting clocks are set with a regulator at the base

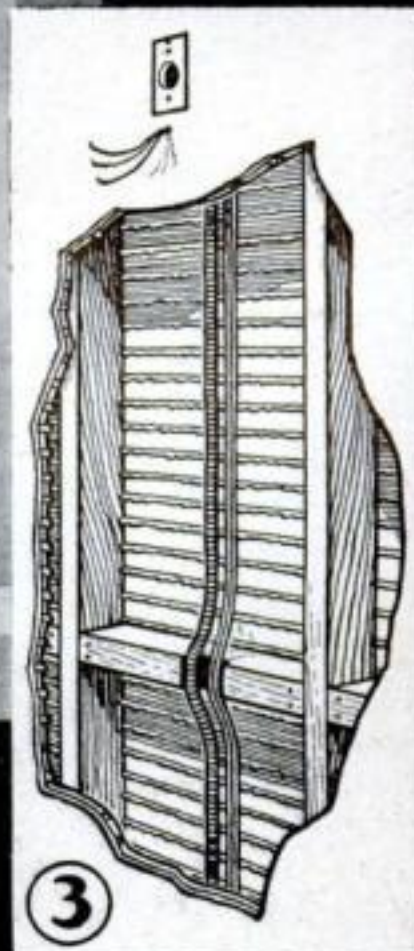


SO MUCH interest was aroused by a paragraph published recently in this department on electric-clock connections that we asked Mr. Strand to explain in detail the best way to install a clock outlet. This is now one of the commonest wiring jobs undertaken by amateur electricians.



IT IS no longer necessary to have a long, unsightly cord running from an electric clock. The proper way to install a clock is to use one of the new special clock outlets with a recessed receptacle, which allows the attachment cap to come flush with the plate. Thus the clock can be placed directly over the outlet so the cord does not show at all. The wiring for this outlet is the same as for any convenience outlet, the only difference being in the receptacle and plate.

In order to illustrate as many problems as possible in the accompanying photos, a new type of





# the Modern Way

By  
**HAROLD P. STRAND**

clock was selected. It has the usual self-starting movement with synchronous motor, but the case also contains two-tone tubular chimes, which can be operated from both front and rear doors. There are obvious advantages in this combination, because the chimes take the place of old-fashioned, noisy bells.

To start the wiring, a hole is bored upwards in the center of the partition from the cellar. A fish wire is passed up into the wall to discover if a clear space exists all the way up. In this instance, blocking was found at the level of the kitchen chair rail. The latter was removed and small holes were cut to pass the wiring over the blocking (Figs. 1 and 3). A hole was also cut in the wall above to fit a standard switch box. In Fig. 1 the BX and three rubber-covered bell wires are being pulled up and through the first hole. The BX will supply the clock motor, and the three bell wires are for the chimes.

The bell wires are brought through a hole in the plaster just below the clock

outlet. In Fig. 2 the switch box is being attached to the cable by tightening the clamp with a screw driver.

The box is fastened with 1" No. 4 flathead screws, and the special clock receptacle is connected to the wires in the usual manner as in Fig. 4. Note the deep offset in the receptacle bar, which carries the cord cap back flush with the plate when the clock is connected. This allows the clock to be placed right over the outlet.

The completed clock outlet is shown in

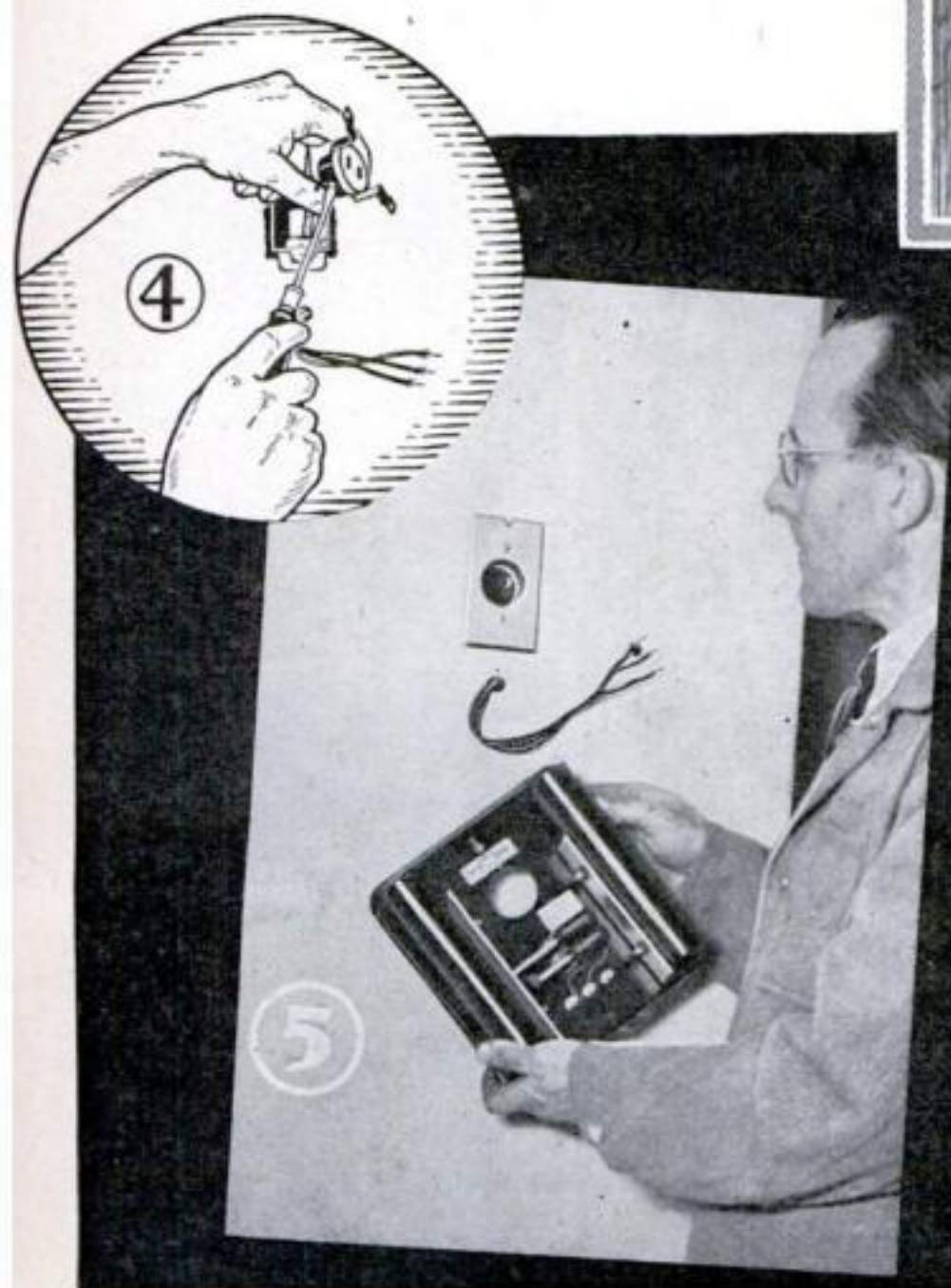
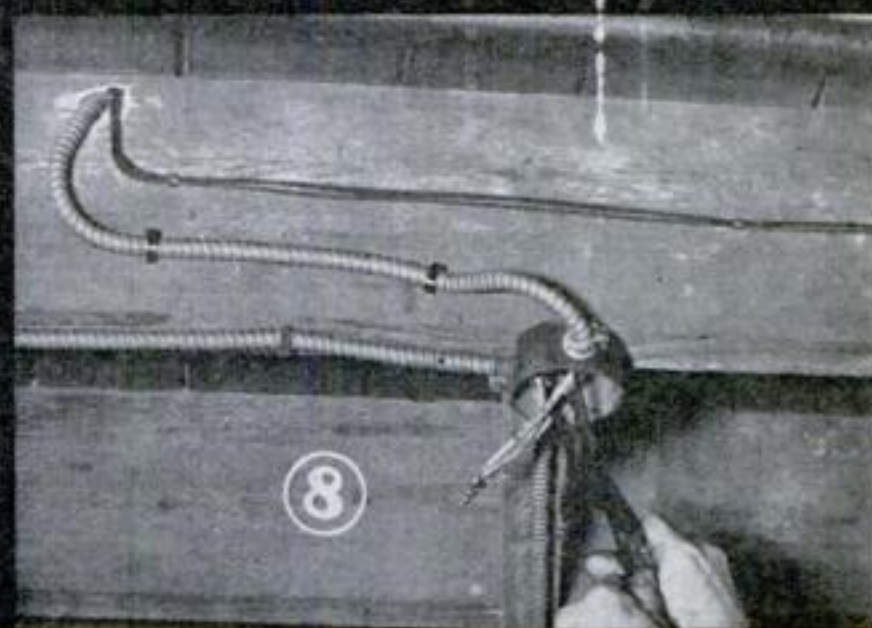
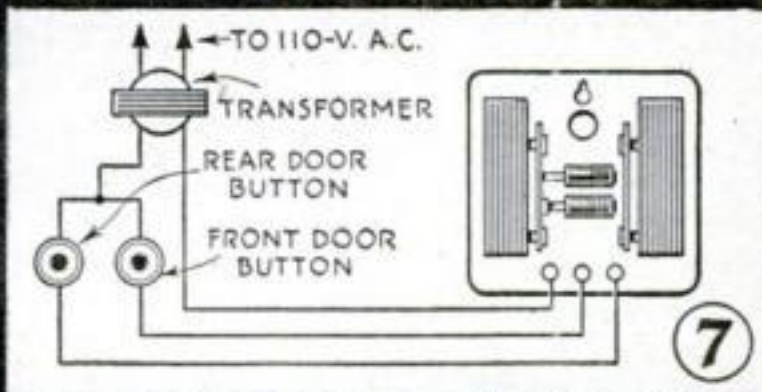




Fig. 5. The writer is holding the base of the chime combination, which is next placed on the wall with the large hole over the center of the outlet. A notched hole at the top fits over a small hook provided at the top of the plate. The bottom is held with one wood screw through a small hole at the lower center. Before making the base fast to the wall, however, the bell wires are brought out through a bushed hole and attached under the three posts. The diagram (Fig. 7) shows the connections.

When all connections are complete, the cord simply plugs into the outlet (Fig. 6). Two small screws, top and bottom, hold the cover to the base. The final step is to replace the chair rail with finish nails, set the heads, and fill with colored putty.

In the cellar the BX cable is carried to a junction box or other suitable point for tapping the current. In this case, a pull-chain cellar light box was handy, as shown in Fig. 8, and it was connected there, the white wire going to the white group and the black wire to the black ones.

Note how two holes had to be bored upward on a slant through the side of a timber,

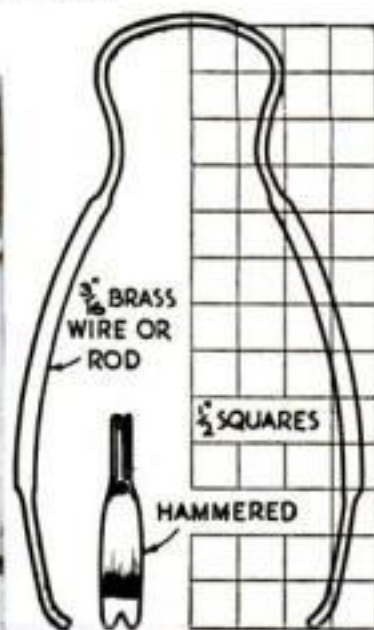
which was found from measurements to be exactly under the partition. The bell wires were stapled to the point where the old bell wires had run up another wall and connected there. It may be necessary to trace out the old wires to find out which one is the feed to the bells and which are front and back button wires.

If the old bell wires do not come down to the cellar, as is often the case, it will be necessary to fish the new bell wires up the wall and connect them to the ends of the old wires. All joints and splices should be soldered, and 110-volt wires must always be covered with both rubber and friction tapes.

## Two Hints for Fishermen

HERE are two hints for fishermen who make their own casting flies: Keep your hooks sorted in 35-mm. film cartridge containers you can obtain from photography enthusiasts. Classify the feathers and put them in bags of transparent cellulose wrapping material through which they can readily be seen.

# Attractive Brass Tongs FOR ICE CUBES



The wire or rod is hammered to shape over a piece of pipe as above. The ends are notched as at the right

THESE ice tongs can be turned out in a jiffy, are inexpensive, and make excellent gifts. Heavy, soft brass wires or rods, from  $\frac{3}{16}$ " to  $\frac{1}{4}$ " in diameter and about 14" long, are required. Each rod is flattened for a space of several inches in the middle and bent, using a piece of pipe for the anvil and form. The hammering will provide the necessary spring tension. The ends are also flattened, and a deep notch is filed in each. Finish the tongs by rubbing to a satin finish with steel wool, then coat them carefully and evenly with clear lacquer to prevent tarnishing, and allow the lacquer to dry.—KENNETH MURRAY.







Craftwork exhibit in hotel lobby by Dickinson (N.Dak.) Community Homeworkshop Club. Right, some of the members with toys they made to give to children



# Lack of Wood Doesn't Stop This Home Workshop Club

**L**UMBER is scarce and expensive on the prairies and in the Bad Lands of North Dakota, but that doesn't deter those who like to make things out of wood. In Dickinson, for example, the men save every wood scrap and cut down the Bad-Lands cedars; then transform them into artistic tables, lamps, and novelties.

Several months ago the Community Homeworkshop Club of Dickinson, a group of thirty men affiliated with the National Homeworkshop Guild, held its first craftwork exhibition in the lobby of a local hotel. It created so much attention that the public began to ask, "Why doesn't this city have

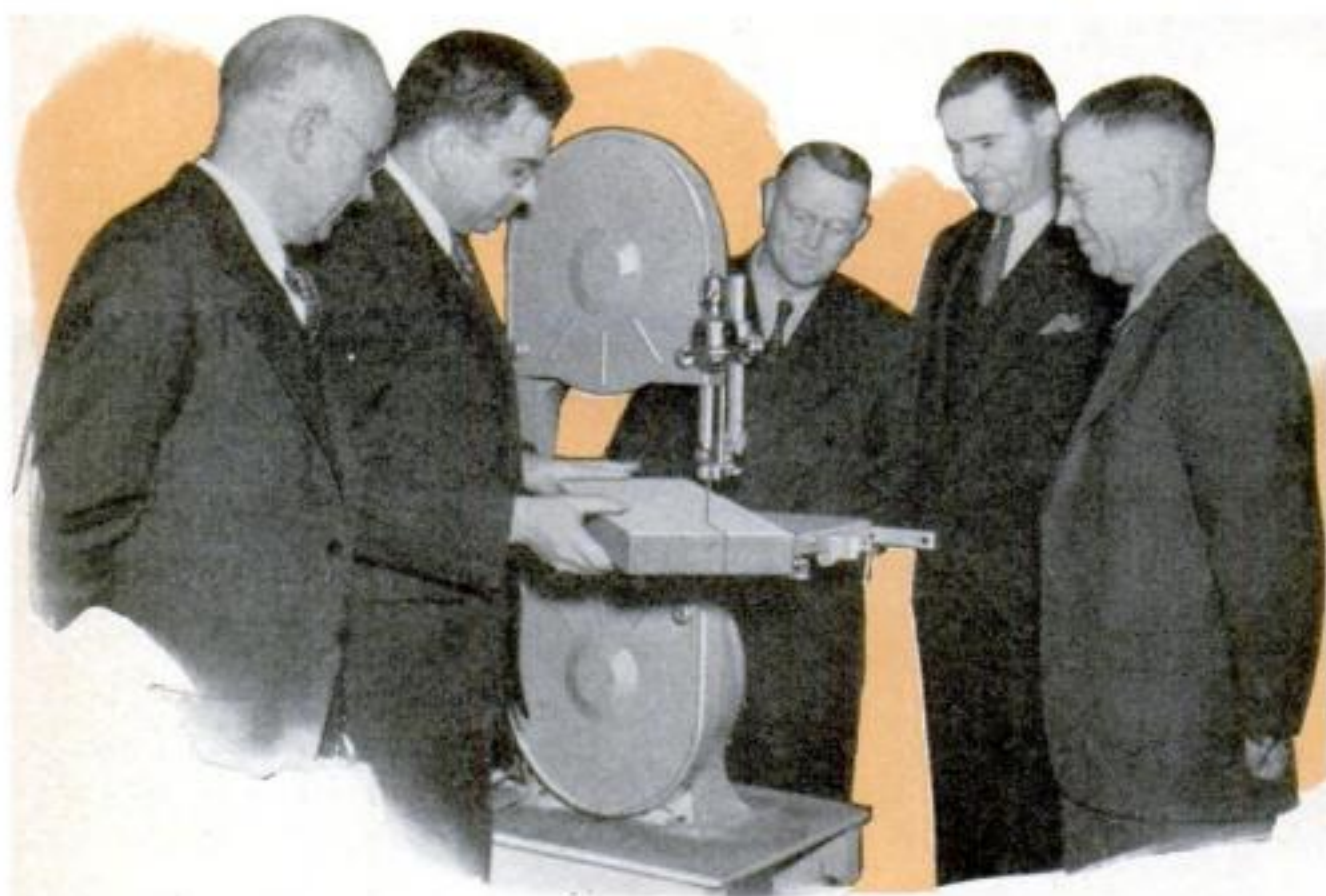
manual training in the schools?" The club took the initiative and is now sponsoring a campaign to bring back a subject taken from the curriculum about eighteen years ago.

In the meantime the members are coöperating with the National Youth Association by assisting the local instructor and lending their own power equipment for several weeks at a time. They have applied for the use of one of the rooms in the large community auditorium now being erected and intend to equip it with power and hand tools. The shop will be maintained for the use of young people until manual training is again





Members of the Ware (Mass.) Craftsman Guild met in the shop of Charles N. Ryan one evening and made fourteen bed trays for Mary Lane Hospital and the district nurse



Five prominent men of Spokane, Wash., enjoy an evening in the workshop. They are members of the Spokane Homecrafters and Inland Workshop Club

placed on the regular school curriculum.

Last Christmas the club gave away toys to 386 poor children. Most of them had been made by members; some were purchased through funds donated by coöperating charity organizations. President Eddie DeFoe tells the story: "Formulating the list of needy children was a real job in itself, because there was no list available. Then we obtained a truck and had one of the members dress up as Santa Claus. We started delivering at 1 o'clock in the afternoon, and we kept going from then until 10:30. We feel we did a real job in making those children happy . . . and we'll do it again."

Other towns and cities throughout the United States and Canada are also benefiting through the activities of home workshop clubs. The *Ware (Mass.)* Craftsman Guild recently presented the Mary Lane Hospital and the district nurse with fourteen invalid

trays the members had made. The Rev. Edward W. McGlenen was in charge of the work.

The *Ashtabula (Ohio)* Homecraft Club is conducting its annual bird-house contest for the city's school children. At recent meetings the members enjoyed a moving picture on veneering, and talks on mahogany, wood carv-

ing, and gluing. A picnic will be held early this summer.

Frank Boylan demonstrated a miniature steam locomotive he had made when the *Portsmouth (Va.)* Homeworkshop Club met in his shop. It burns oil and carries thirty-five pounds of steam. Glenn Covert announced that he had indexed all his books, plans, and charts and that they could be used by the members at any time.

Projects made by members were displayed and explained at a meeting of the *Oelwein (Iowa)* Homeworkshop Club as follows: H. E. Wells, archery equipment; George Miller, wooden goblets; J. R. Sinclair, walnut beer service; C. H. Leaton, cabinet; Paul H. Kinsman, shelves, game board, and match holder; and G. W. Myers, gold rings and a nut bowl. G. D. Cooper spoke on cutting and polishing semiprecious stones.

A corner cupboard is being built by the



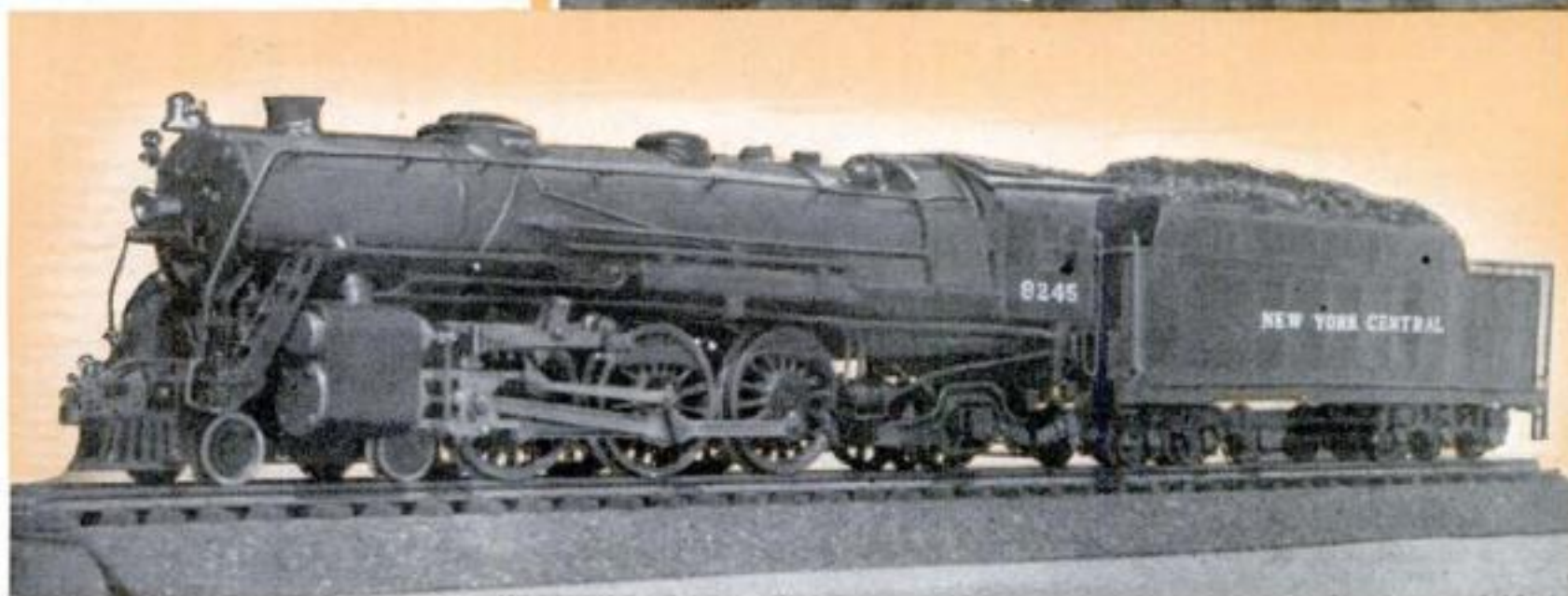
**York (Pa.)** Homeworkshop Club and will be sold for the benefit of the club fund . . . **Ralph L. Jenner** took the **LeRoy (N. Y.)** Homeworkshop Club on a tour of inspection of a local manufacturing plant recently . . . The Women's Auxiliary of the local Fire Department assisted the **Kingston (N. H.)** Workshop Guild in preparing a list of needy boys and girls. Toys were given to the children . . . The **Newark (N. J.)** Homeworkshop Club has been divided into two divisions: those who like woodworking and those interested in photography . . . The **Bison homeworkshop Guild, Buffalo, N. Y.,** celebrated its sixth anniversary with a dinner party for members, families, and friends. The club has its own banner and adds a star each year . . . The **Denver (Colo.)** Missionary Volunteer Homeworkshop Guild plans to conduct classes in various crafts.

**E. E. Studley** won first prize in the annual exhibition of the **San Diego (Calif.)** Homecraft Club. Other prizes were won by **G. W. Henderson, Hulbert Hull, J. I. Ballinger, L. C. Brown, and Dr. F. Dennis.** There were eighty-two projects on display.

**D. W. Brown,** representing a local veneering company, spoke before the **Gem City Homeworkshop**

**Robert Jones, right, president of the San Diego (Calif.) Homecraft Club,** presents a check to **Earl Studley, winner of first prize in the annual exhibition.** Below, model steam locomotive built by **F. A. Boylan, of the Portsmouth (Va.) Homeworkshop Club.** The model burns oil

Club, **Dayton, Ohio,** and moving pictures on inlaying and veneering were shown . . . **M. D. Franklin** exhibited wood-carving projects at a meeting of the **Montgomery Homeworkshop Club at Bethesda, Md.,** **Leroy Allison** showed how to file a saw, and **C. C. Clagert** demonstrated how to sharpen chisels . . . A joint meeting of the **Zane Homeworkshop Club of Zanesville, Ohio,** and the **Mound Builders Homeworkshop Club** was held at the latter's headquarters in **Newark, Ohio . . .** The **Fort Stanwix Hobby Club, Rome, N. Y.,** has set up a club workshop in the basement of a city playground clubhouse.





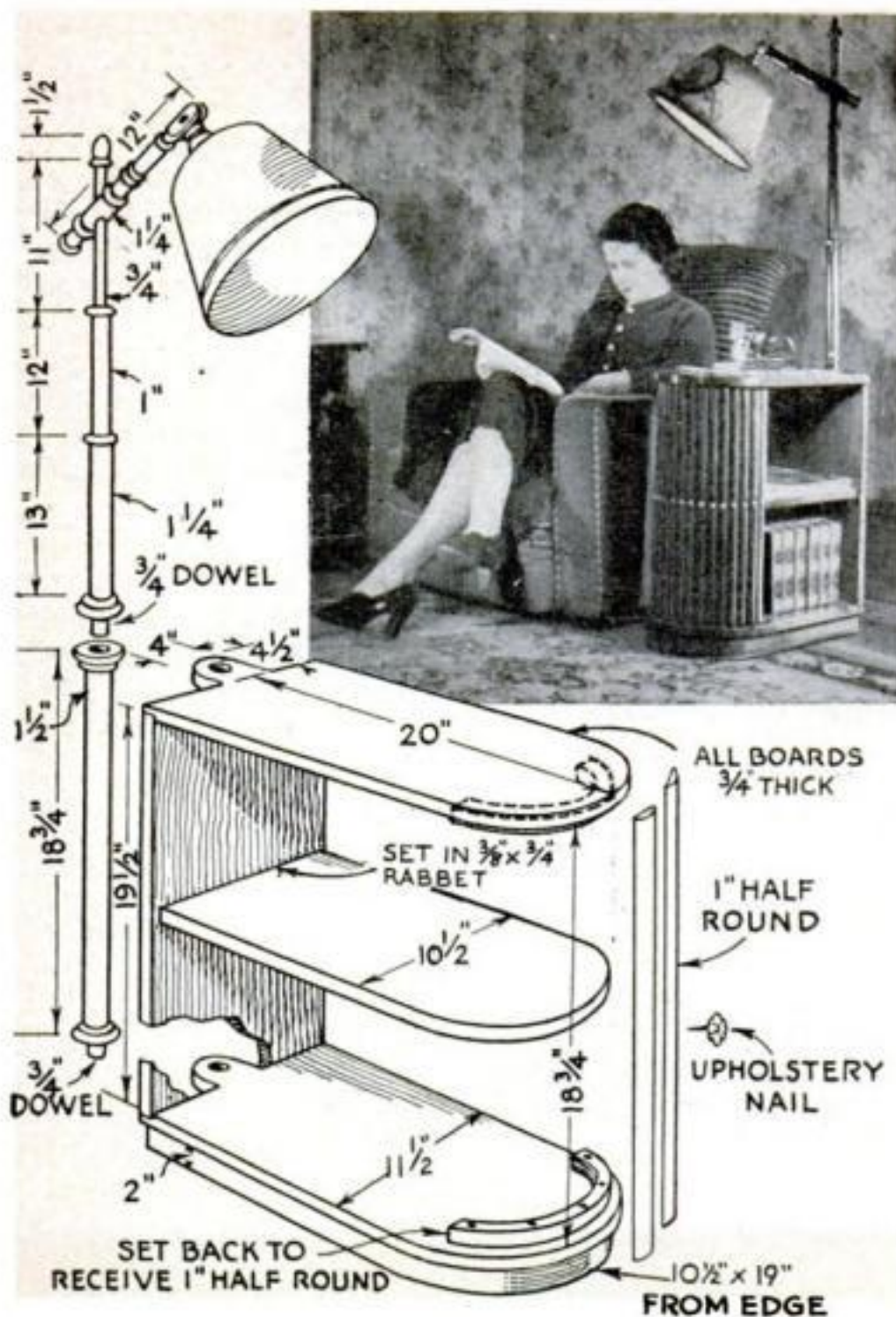
# MODERNISTIC End Table COMBINED WITH Reading Lamp

was built of pine by Adelard Richard.

The parts of the stand proper are cut as shown and assembled with dadoed and rabbeted joints. The rounded end is formed by gluing a number of lengths of 1" half-round molding to blocks cut to conform to the curved middle shelf and fastened as illustrated. The half-round pieces are also securely screwed to the curved end of the middle shelf.

The lamp standard is made in two lengths. The arm is 12" long and has a  $\frac{3}{4}$ " hole drilled at an angle to fit over the top of the standard. For 2" at the other end, the arm is cut flat to enable the lamp socket to be attached. When the arm has been set in place, the top of the standard is finished off with a  $1\frac{1}{2}$ " long cone-shaped tip. To keep the

construction as simple as possible, the lamp cord is merely carried back over the arm and down to a base outlet. Of course, by making slight changes in the design, the turnings could be bored and the electric cord carried through them to the base and thence to the outlet.



**T**HIS space-saving end table has a turned lamp standard that throws the light down in such a way as to give the most comfortable illumination for reading. The design was worked out by Charles Jeglinski, of the Timbercraft Homeworkshop Club, New Bedford, Mass., and the original model, shown above,

## Slats Woven Together to Fill Fence Panels

DECORATIVE fences or trellises may be built by using posts and substantial upper and lower rails in the usual way, then filling in the panels with  $\frac{1}{4}$ " by 2" wooden slats, woven into attractive patterns. The builder's originality may be put to work in designing various patterns for weaving the wooden slats. This type of fence will be found durable and pleasing to the eye; it provides semiprivacy, yet is relatively inexpensive to make.—GAIL M. FOSTER.

Subscribers are requested to notify us of change of address four weeks in advance of the next publication date. Please be sure to give both old and new address.



One of many possible patterns in which the slats can be interlaced



# HERE'S HOW YOU CAN JOIN THE National Homeworkshop Guild



**1** Fill out coupon at bottom of page and send for details on how to start a home workshop club.



**2** You will receive a letter about the Guild, a bulletin on organizing a club, and an application blank for a free charter.



**3** Talk the idea over with friends. Ask them to spread the word that a home workshop club is to be started.



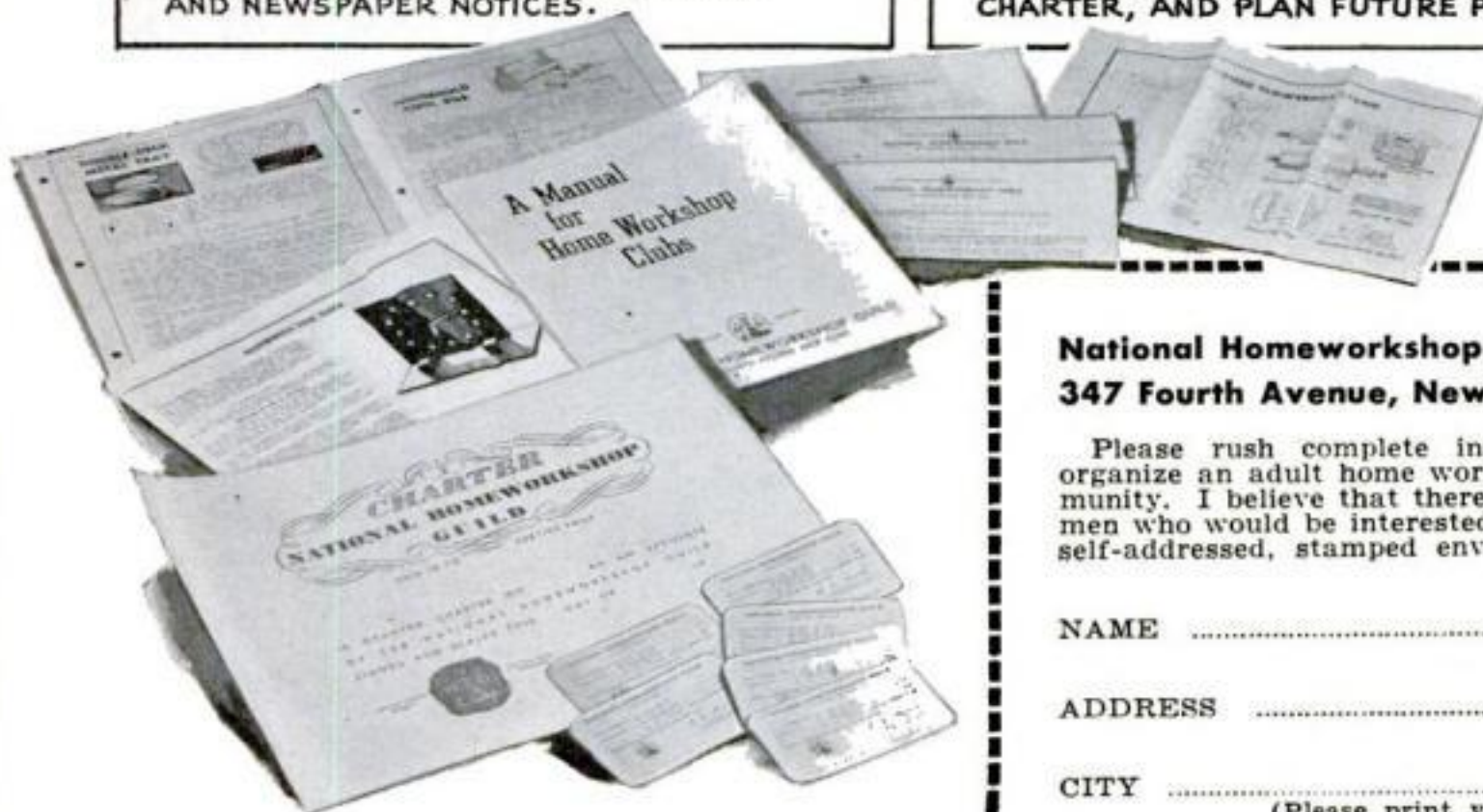
**4** Get the support of hardware dealers. Ask for names and addresses of persons who might be interested.



**5** Set a date for the first meeting and announce it by means of posters and newspaper notices.



**6** At your first meeting elect temporary officers, fill out application blank for charter, and plan future programs.



Each club gets a charter, job sheets, cards, and bulletins

**National Homeworkshop Guild  
347 Fourth Avenue, New York**

Please rush complete information on how to organize an adult home workshop club in my community. I believe that there are at least five other men who would be interested. A large (legal size), self-addressed, stamped envelope is inclosed.

NAME .....

ADDRESS .....

CITY ..... STATE.....  
(Please print very clearly)



# 3 DUSTPROOF METHODS OF Framing Pictures

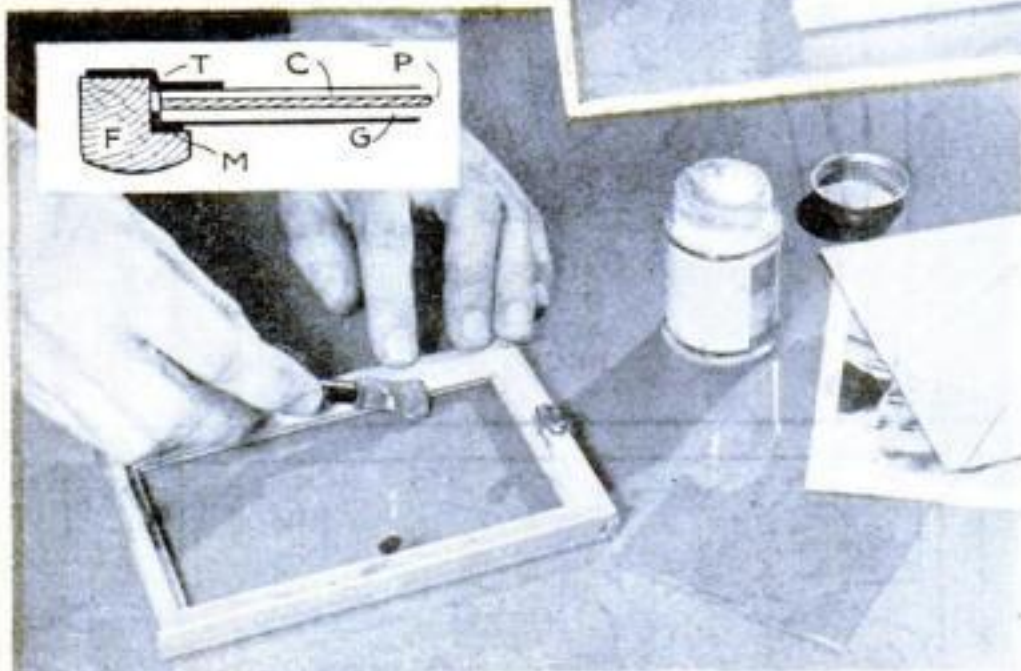
## Key to Diagrams

F-FRAME T-TAPE  
G-GLASS P-PICTURE  
C-CARDBOARD BACK  
M-PUTTY OR MASTIC

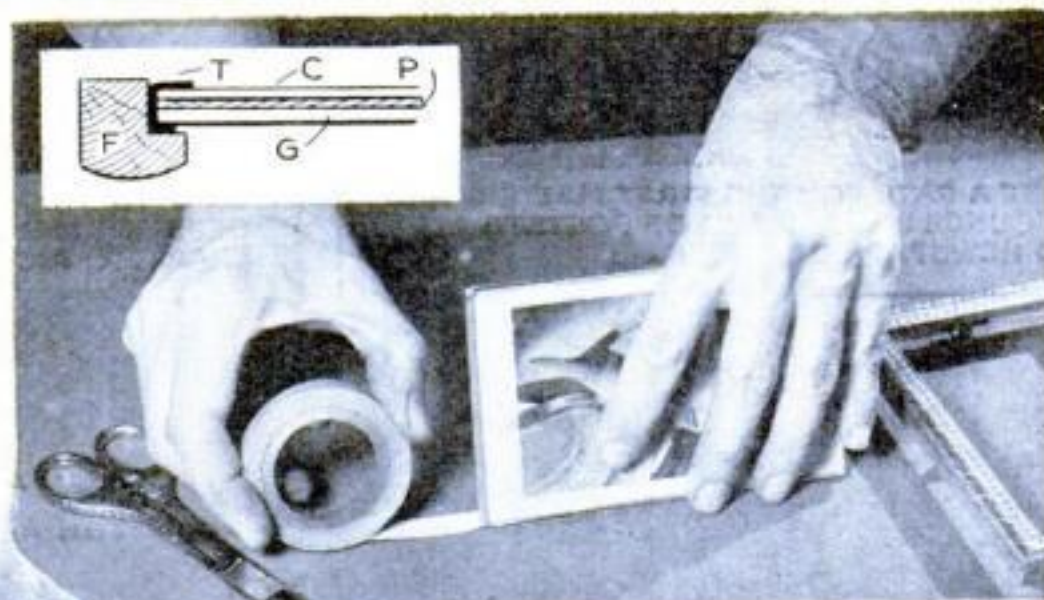
**N**OTHING spoils the appearance of a framed photograph or other picture more quickly than dust that sifts around the edges of the glass and makes streaks across the mount and print. With a little extra effort in framing, this trouble can be eliminated. Three effective ways are illustrated



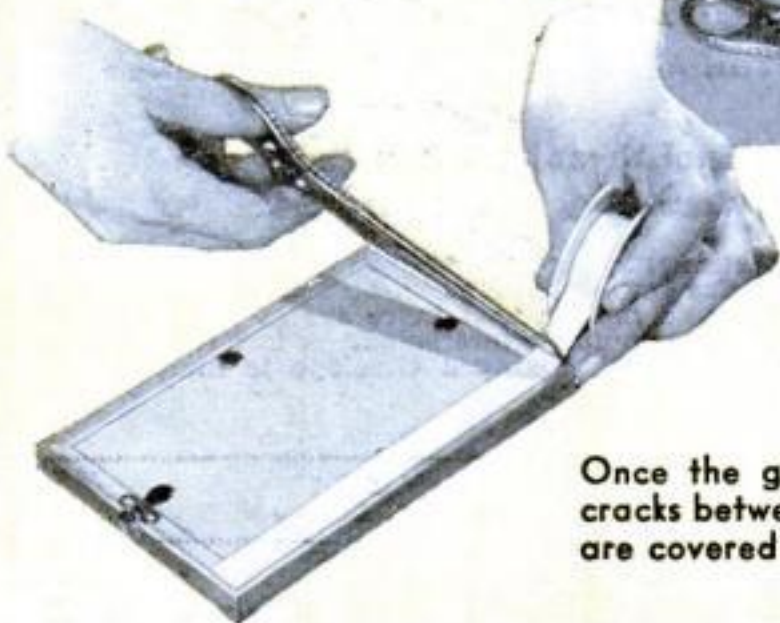
**First method:** Place the glass in the frame and stick a narrow strip of tape tightly to it and to the adjacent rabbeted-out part of the frame. Use either a tape with a good water-soluble mucilage or an adhesive tape such as that sold for binding lantern slides. Inferior tapes may harden and come loose in time. Insert the picture and the cardboard backing, and then run tape along the four sides to seal the crack between frame and cardboard



**Second method:** Set the glass in a good grade of putty such as that made from white lead, mastic of the type used to fasten glass in metal sash, rubber putty, or other crack filler. Run a narrow line of it around the frame rabbet, press the glass in place, and remove any excess. Finally, insert the picture and backing, and cover the cracks with gummed tape



**Third method:** Sandwich the picture between a sheet of glass and a piece of stiff cardboard cut to fit the frame. Bind the edges with tape, letting it overlap the glass enough to make a firm seal but not enough to show when the picture is set in place



Once the glass has been sealed in, the cracks between the backing and the frame are covered with any tape that sticks well



# Empty Oil Cans Lighten Concrete Lawn Roller



**A** HOMEMADE lawn roller, if made of solid concrete, is likely to be too heavy, but it can be lightened by using empty oil cans, obtainable at any gasoline service station. The cans are distributed through the concrete as shown.

As a form for the roller, a sheet-iron drum of suitable size is set on end after a hole for an iron pipe or shaft has been centered in one end. Cross sticks center the shaft in the open end. The bottom is covered with concrete, and a layer of the cans is set, open end

down, upon it. They must clear the drum by at least 1". Concrete is then tamped around and over them, and additional layers of empty cans and concrete are added to within an inch or two of the top, which is finished with a layer of rich concrete. Use a rather dry, stiff mixture with plenty of cement.

The wooden handle frame shown is simple and sturdy, but one can be made of pipe and fittings if preferred.—R. L. K.



## Small Lamp Tests Blasting Battery

SUBWAY blasters and quarymen who wish to be sure a blasting battery is in working condition, can test it with a series-type Christmas-tree lamp and a short section of wire with socket attached from the light set. The bulb should light up brightly when contact is made.—ANTHONY WALLACE.

## Wire Fences Protect Beehives

TO PROTECT his beehives from horses and other live stock that were turned into the orchard at night, one beekeeper constructed portable "wigwam" fences. These were made from poles with a couple of strands of barbed wire stapled to them. They provide ample protection for the hives, yet are easily removed whenever it is necessary to gain access to the bees. Sink the ends of the poles into the ground so they cannot be knocked over.

...

STRONG, weatherproof covering material for model airplanes can be prepared by soaking ordinary tissue paper in rubber cement mixed very thin with benzine. Hang the sheets to dry in a horizontal position, otherwise the coating will be uneven.—J. R. H.





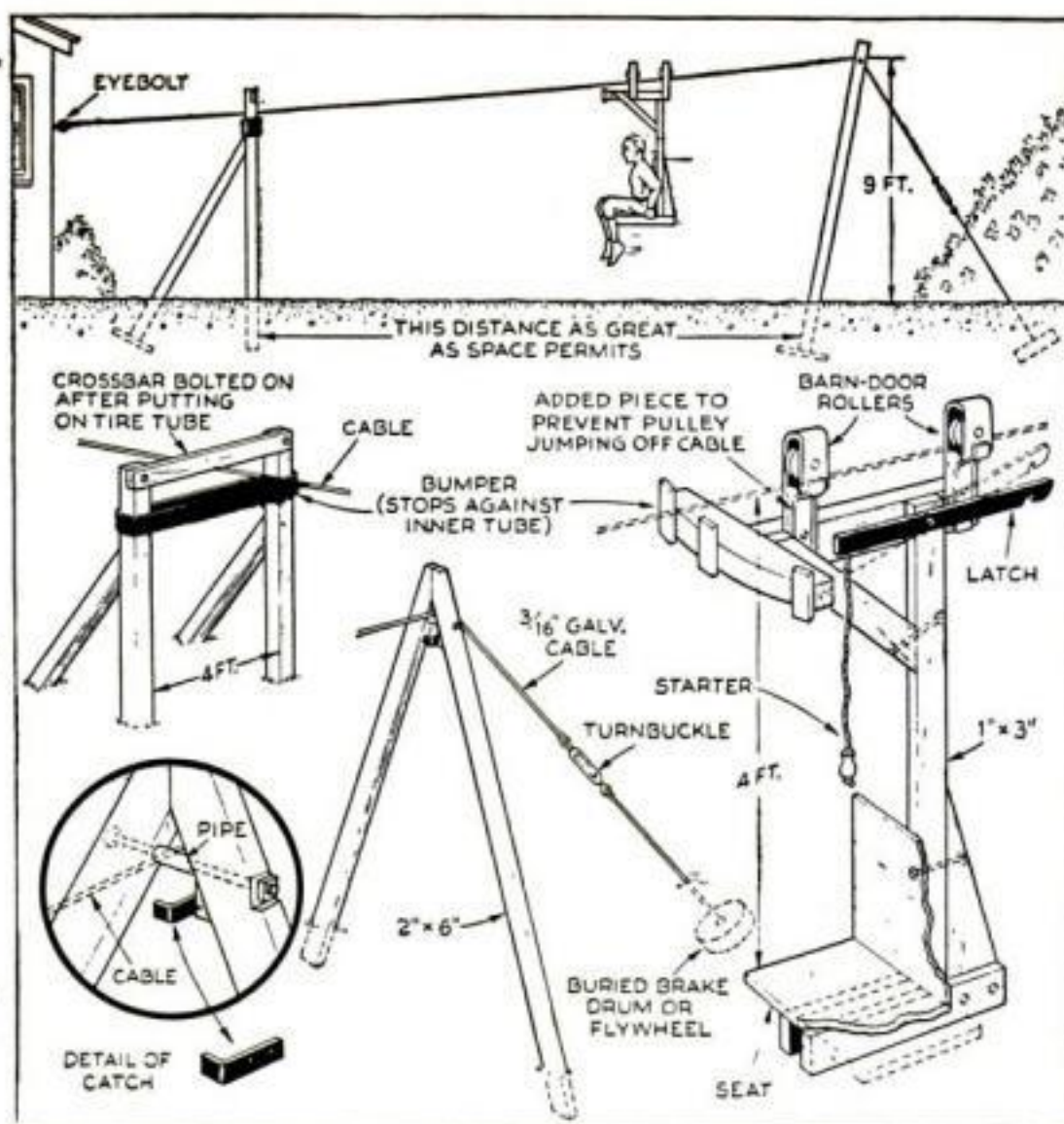


## BACK-YARD Aerial Glide PROVIDES THRILLS

SLIDING down a wire has always held a fascination for small boys, and here is a device that gives a thrilling ride of this kind with perfect safety. A galvanized cable is stretched from a garage or other structure to an inverted V-shaped frame and made taut with a stout turnbuckle. The end is anchored to a buried brake drum or other piece

## Printing Ink Kept Ready in Inverted Cans

WHEN ink is to be used at frequent intervals during a long press run in a job-printing shop, it is not necessary to waste time in opening and closing the tight-fitting cover of the ink can each time. Simply remove the can cover and invert the can over a sheet of glass which has been coated with oil to prevent sticking. The can will be sealed sufficiently to prevent the contents from drying, yet the ink will be ready for instant use when needed.—G. E. H.



How the glide is set up. One end of the cable can be attached to the garage if well braced

of junk. Rocks are piled in the hole and loose soil washed in with the hose.

The carriage is hung on two barn-door rollers with a strip of strap iron to prevent jumping off the cable. A wood bumper in front strikes an inner tube stretched over a frame and thus brings the carriage to a gentle stop. Note that the design of the seat permits the passenger to hop off anywhere along the line. A pile of straw could be placed at the foot of the run for the passenger to jump into.—DICK HIXON.

## A Heavy-Duty Lamp Cord

HEAVY-DUTY electrical wire for use with photoflood lamps or other fixtures drawing much current is rather expensive and not always easy to obtain. An excellent substitute is ordinary No. 18 flat lamp cord. Skin the ends, twist each pair together, and use as if the pair were a single wire.







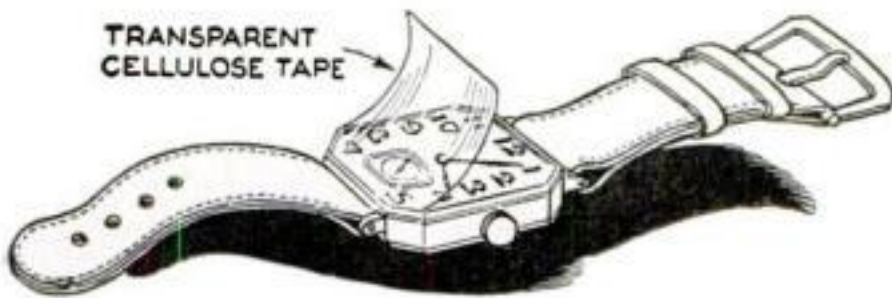
## Welding Rod Makes Handle for Lunch Kit

IF THE leather handle on a lunch kit tears or becomes badly soiled, a good substitute can be made by bending a soft

3/16" welding rod as shown and inserting it under the handle fasteners. This handle is easy to keep clean and is not in the way when the lunch kit is opened since it will swing to either side.—A. W.

## Cellulose Tape Reënforces Wrist-Watch Crystal

PROVIDED no parts have fallen out, the cracked crystal of a wrist watch can be temporarily repaired by the application of a piece of transparent cellulose tape. Wrist watches that are to receive unusually hard service can be given this treatment in advance so that the crystal, if broken, will not fall out and expose the watch hands and dials to injury.—ROBERT C. BLACKMON.



## Band-Saw Guard Reversed for Better Protection

THE wooden guard on 10" band saws of the type illustrated above often comes with the blade slot facing toward the front. Additional safety can be assured by reversing the guard so that the slot faces in, thus giving the operator more complete protection from broken blades. It is a simple matter to remove the guard when it is necessary to change blades.—F. H. M.

## BIRD-HOUSE DIMENSIONS

[WOODWORKING]

Species	Floor area	Entrance above floor	Depth of compartment	Dia. of entrance
Bluebird.....	5 by 5	6	8	1½
Robin.....	6 " 8	one side open	8	
Chickadee.....	4 " 4	6-8	8-10	1½
House wren.....	4 " 4	1-6	6-8	1
Barn swallow.....	6 " 6	one side open	6	
Flicker.....	7 " 7	14-16	16-18	2½
Red-headed woodpecker	6 " 6	9-12	12-15	2

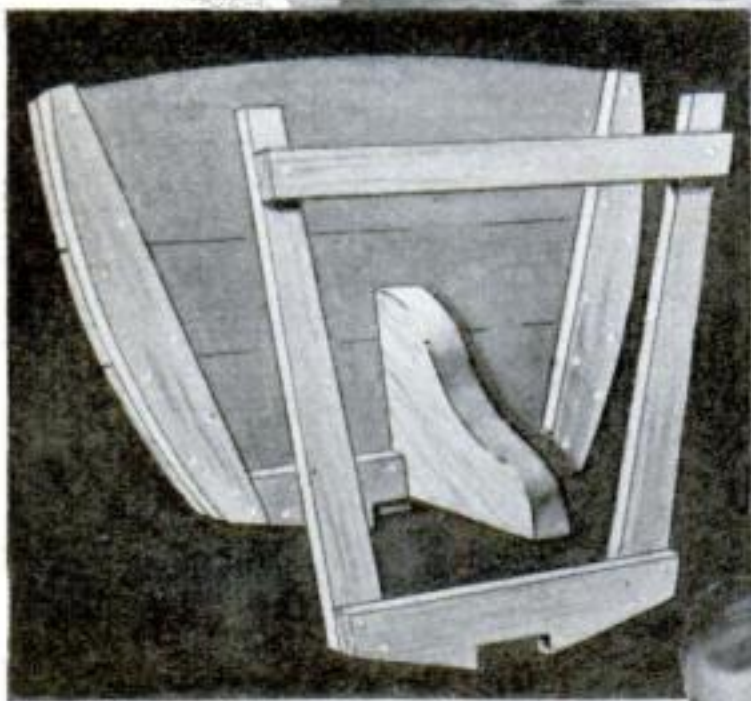
NOTE: All dimensions are given in inches. The height above ground may vary as follows: bluebird, 5' to 10'; robin and chickadee, 6' to 15'; house wren, 6' to 10'; barn swallow, 8' to 12'; flicker, 6' to 20'; woodpecker, 12' to 20'. These specifications are recommended in "Homes for Birds," Farmers' Bulletin No. 1456, U. S. Dept. of Agriculture. If several bird families are to use one house, separate the interior with thin wood or plywood into apartments of the sizes given.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



# 60 Miles on a

WITH OUR NEW



Overall length of boat, 15'; beam, 52"; draft, 10"; weight, 250 to 400 lb.; passengers, 6; motor,  $\frac{1}{2}$  to 5 h.p.; speed, 5 to 10 m.p.h.; cost, \$75 to \$100

Above, assembled transom and one of the frames. Below, screwing keelson to frames set up on form



SETTING a new high in economy of operation, our new 15' boat *Waltonian* is designed for fishing and any general use that requires a seaworthy, low-cost, practical inboard motor boat. The remarkable economy in fuel—60 miles to a gallon of gasoline or even more—is made possible through

a special design that assures maximum efficiency from the new air-cooled marine motors now on the market.

Such inherently important factors as seaworthiness and shallow draft have in no way been sacrificed in obtaining this efficiency. Its ability to ride high seas and the fact that an air-cooled motor is not subject to the corrosive action of salt water combine to make the boat ideal for salt-water use. Any desired trolling speed may be had.

The hull is of a simplified V-bottom type, as easy to build as a flat-bottom boat. There is no difficult bending, and most of the planks can be put on in straight pieces with little or no fitting. The small, light motor offers no installation problems. Marine plywood may be used instead of planking, if desired, eliminating the need of battens and substantially reducing the total weight.

The cost of construction is on a par with the low operating expense. In localities where lumber is reasonable, the cost of the entire boat, using batten-seam construction and including the motor and all necessary equipment, should be only about \$75.

The speed obtained with the  $\frac{3}{4}$ -h.p. motor shown in the



# Gallon of Gas

By BRUCE  
and WILLARD  
CRANDALL

## INBOARD MOTOR BOAT "WALTONIAN"

photographs was between 6 and 7 m.p.h. This may be increased to as much as 10 m.p.h. by the use of a 4- or 5-h.p. motor, but a considerable increase in operating expense will, of course, result.

If desired, the entire boat may be drawn full size before starting construction. Use the measurements given in the table of offsets and accompanying drawings and deduct the thickness of the planking from the full-size drawings before making the frames. This drawing is not essential, however, as the work has already been done, and it is only necessary to draw full-size patterns of the frames, stem, and transom; or the patterns may be purchased already drawn.

For the drawing of each pattern, use a sheet of wrapping paper large enough for the assembled frame and fold it in the middle in such a way that the fold will represent the center line. Draw the base line, and water line No. 2 where needed, at right angles to the center line. Draw the side and bottom frames on one side according to the measurements given in the drawings; and when one half is completed, punch through the paper at the important points, unfold, and draw the other half. The curves are drawn with the aid of a light batten bent to shape and held in place with brads.

The shape of the frames is transferred to the frame material by placing the patterns over it and then pricking through at the important points. All the bottom frames are made in one piece, and the straight side frames can be made by ripping a 6" board, leaving the frames each 2" wide at the top

### LIST OF MATERIALS

White cedar, mahogany, red cedar, cypress, white pine, fir, spruce, or redwood (in order of preference).

For	No. Pc.	Size
Side planks	4	$\frac{1}{2}$ " x 8" x 16'
	4	$\frac{1}{2}$ " x 6" x 16'
Bottom planks and transom	2	$\frac{1}{2}$ " x 6" x 14'
Battens	4	$\frac{1}{2}$ " x 8" x 14'
	8	$\frac{1}{2}$ " x $1\frac{1}{4}$ " x 16'
	4	$\frac{1}{2}$ " x $1\frac{1}{4}$ " x 14'
Seats	1	$\frac{3}{4}$ " x 12" x 10'
Seat backs	1	$\frac{3}{4}$ " x 10" x 12'
Floor boards	4	$\frac{1}{2}$ " x 6" x 10'
Deck	1	$\frac{3}{8}$ " x 6" x 16'

The following may be used in place of the above list: Marine plywood—either mahogany or fir.

Sides	1	$\frac{3}{8}$ " x 4' x 16'
Bottom	1	$\frac{3}{8}$ " x 4' x 14'
Floor, seats, and transom	1	$\frac{3}{8}$ " x 4' x 8'
Deck and seat backs	1	$\frac{1}{4}$ " x 4' x 8'

White oak, mahogany, yellow pine, spruce, fir, cypress, cedar, white pine, or redwood.

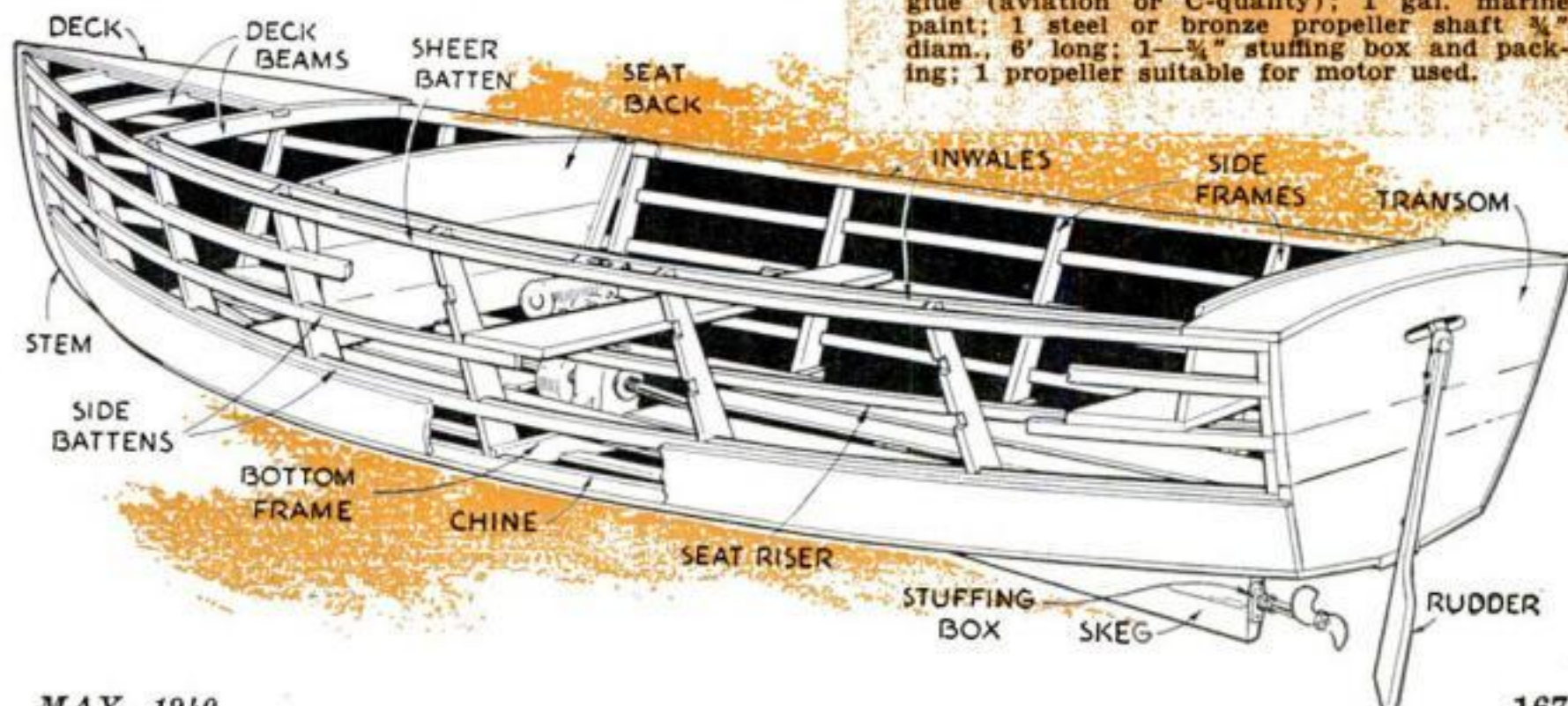
Keel	1	$\frac{3}{4}$ " x 4" x 16'
Keelson	1	$\frac{3}{4}$ " x 6" x 14'
Stem, engine beds, knees, and skeg	1	$1\frac{1}{4}$ " x 8" x 10'
Frames, deck beams, and rudder	1	$\frac{3}{4}$ " x 6" x 16'
	1	$\frac{3}{4}$ " x 10" x 16'
Chines, inwales, and seat risers	5	$\frac{3}{4}$ " x $1\frac{1}{4}$ " x 16'
Half-round	2	$1\frac{1}{4}$ " x 16'

Any cheap lumber.

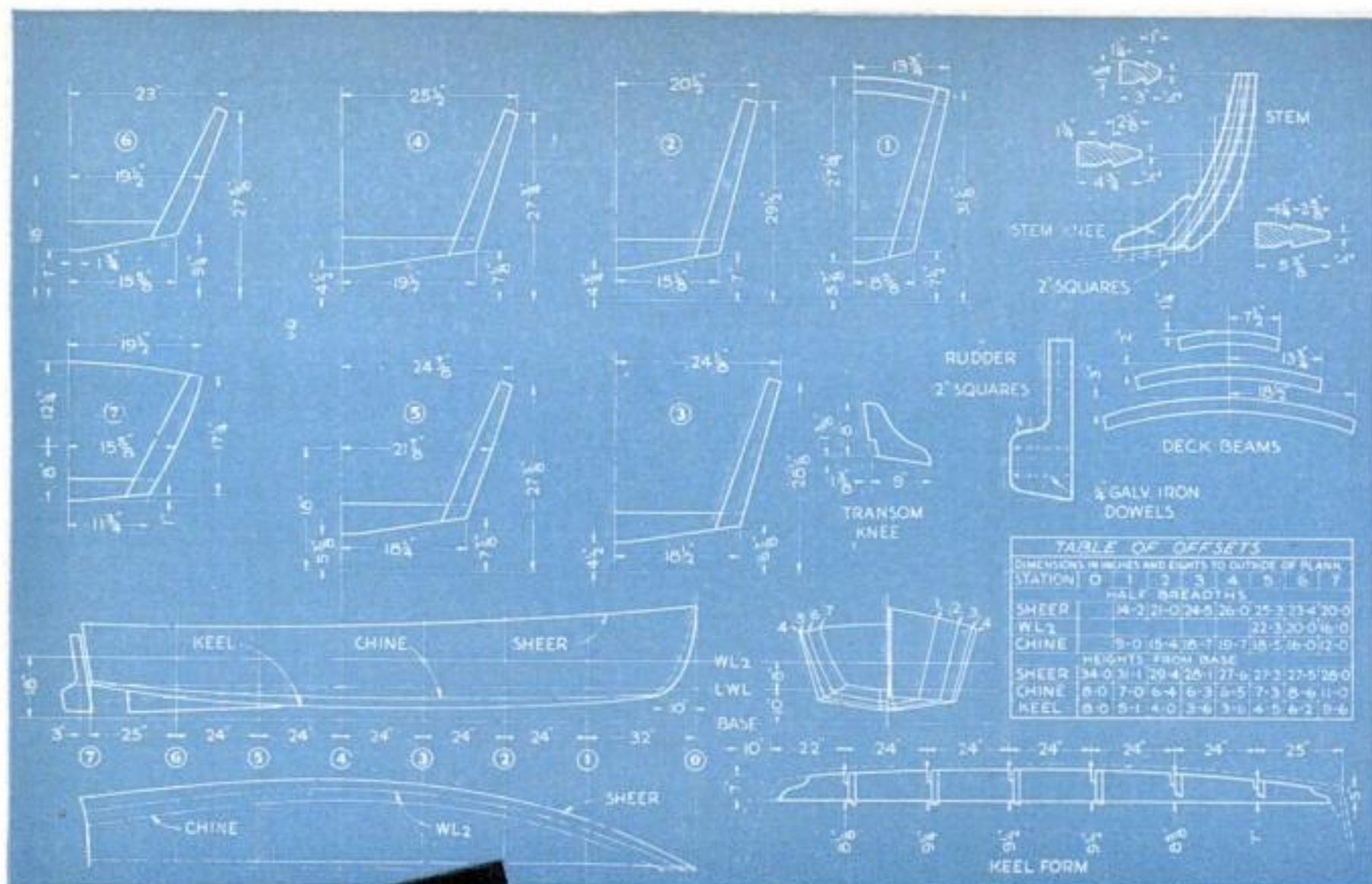
Keel form	1	1" x 10" x 14'
Uprights and braces	4	1" x 2" x 16' net.

### HARDWARE AND MISCELLANEOUS

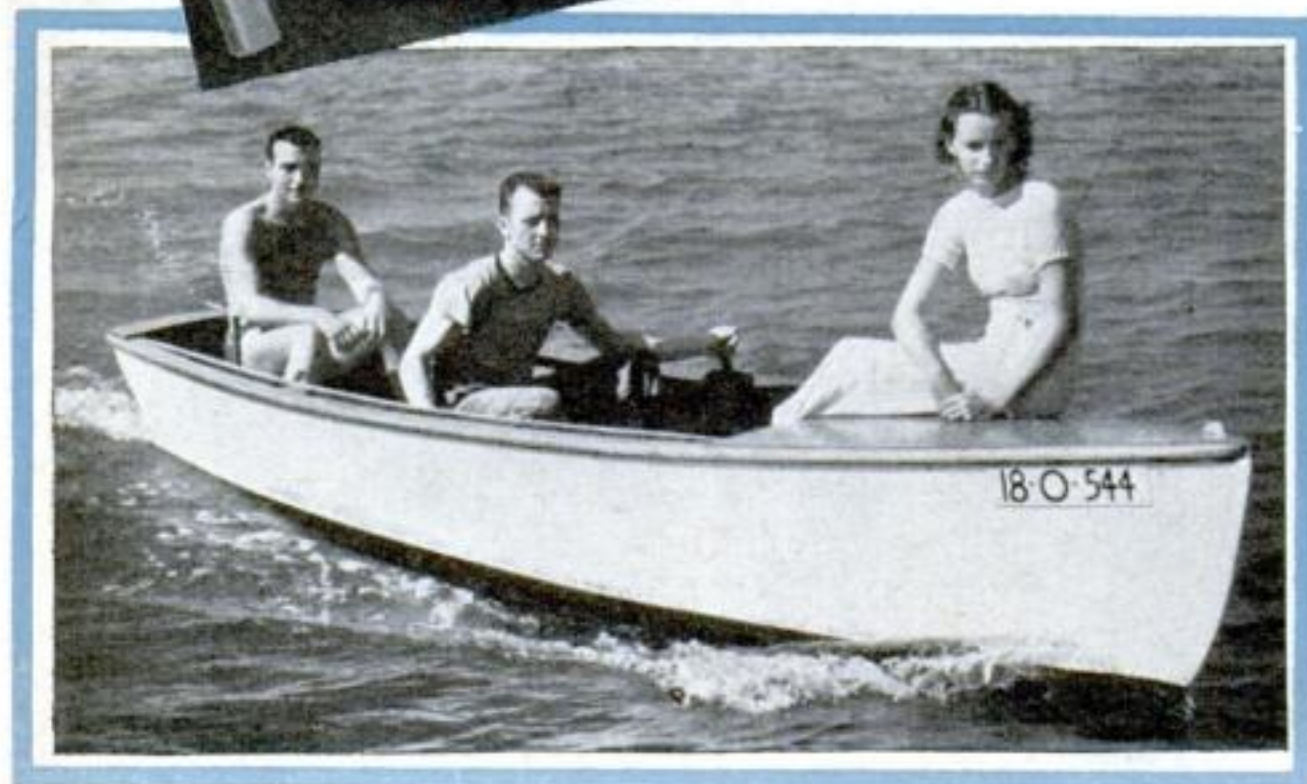
Flathead brass, galvanized, or cadmium-plated screws as follows: 7 gross  $1\frac{1}{4}$ " No. 8, 3 gross  $1\frac{1}{2}$ " No. 8, 1 gross  $1\frac{1}{4}$ " No. 10, 2 doz.  $2\frac{1}{2}$ " No. 12; 5 lb.  $1\frac{1}{4}$ " galv. nails, or copper nails and burrs (not needed if plywood is used for planking); 1—7/16" by 12" galv. machine bolt; 4— $\frac{1}{4}$ " by 6" galv. machine or carriage bolts; 10—5/16" by 4" galv. lag screws; 4 rudder gudgeons or  $\frac{1}{4}$ " by 2" screw-eye bolts; 4 galv. pulleys or blocks; 25' of 3/16" or  $\frac{1}{4}$ " tiller rope; 1 pr. oarlocks; 1—4" deck cleat; 1 pr. bow chocks; 3' of  $\frac{5}{8}$ " by 3/16" half-oval galv. iron or brass; 5 yd. cotton flannelette; 1 qt. marine glue (aviation or C-quality); 1 gal. marine paint; 1 steel or bronze propeller shaft  $\frac{3}{4}$ " diam., 6' long; 1— $\frac{3}{4}$ " stuffing box and packing; 1 propeller suitable for motor used.







Left, cutting rabbet in stem. Below, 6 m.p.h. is easy with only  $\frac{3}{4}$  h.p.



edge. The frames should be in position over the patterns while they are being fastened together at the corners. Either  $1\frac{1}{2}$ " screws or 2" bolts can be used, but these fastenings must be set in enough to allow for the chine notches. The transom planking should be screwed to the transom framework with  $1\frac{1}{4}$ " No. 8 screws spaced 3" or 4" apart.

Nail temporary pieces across the top of all the side frames and mark the center line on these pieces, on the deck beam of No. 1, and on all the bottom frames and the transom.

Notches for the keelson can now be cut in the exact center of each bottom frame, including the transom frame, but not in the transom planking. The stem and stem knee are cut out according to the dimensions given and fastened together with one 6" bolt and with several  $2\frac{1}{2}$ " No. 12 screws. The exact angles of the stem rabbet are best determined after the stem and frames are set up.

The hull should be built upside down on a framework supported from the floor or from two timbers.



The essential part of this framework consists of the keel form on which the keelson, frames, and stem and transom knees will rest. Cut the keel form from a 1" by 10" plank as indicated and cut notches where the bottom frames will rest, just deep enough so that the keelson notches are flush with the edge of the keel form. Nail uprights at each station and set the keel form up at a convenient height for working, braced as shown. The uprights should be perfectly plumb and at right angles to the keel form. The frames should be set in the notches and temporarily fastened to the uprights in such a way that their center lines are perfectly plumb and at the center of the keel form.

The keelson, stem and stem knee, and transom and transom knee may now be set up. Clamp the keel temporarily in position in order to determine the extent of the bevel of the keelson. The keel and keelson must both be tapered slightly at the forward end. After checking to be sure that the transom and stem are in perfect alignment, screw the keel and keelson to the transom and transom knee, and stem and stem knee, with 1½" No. 8, 1¾" No. 10, and 2½" No. 12 screws. The transom knee is also screwed to the transom, and 6" bolts are used as shown in the drawings. The keel and keelson are screwed to the bottom frames with 1¾" No. 10 screws, and the keel is fastened to the keelson about every 6" with 1¼" No. 8 screws.

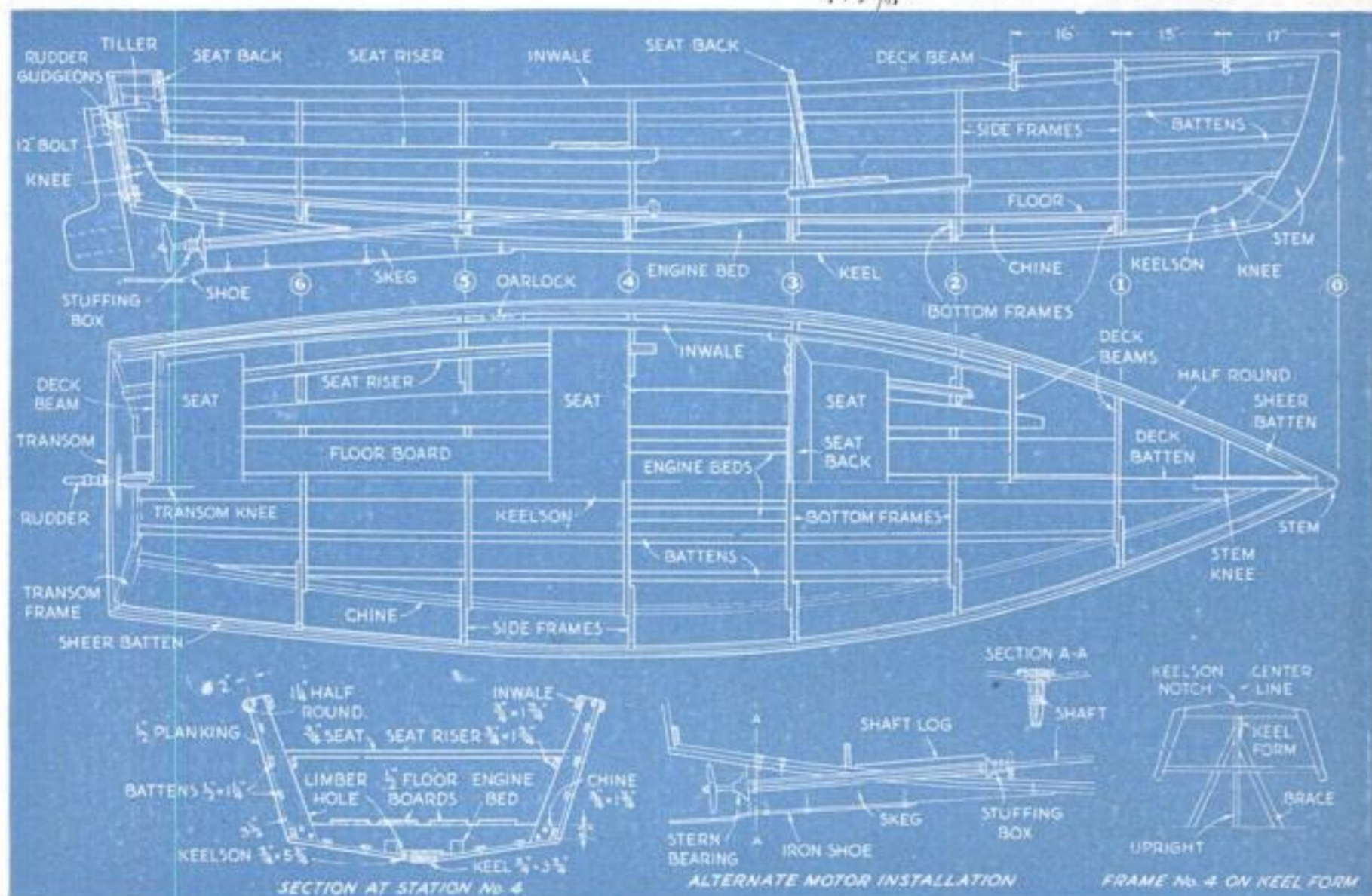
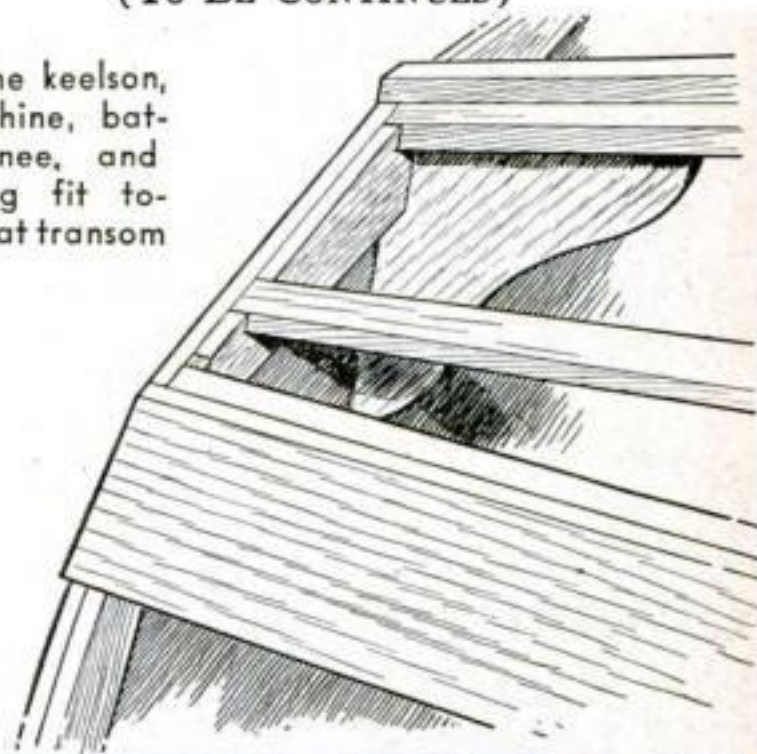
After making sure that the stem is in per-

fect alignment and that the frames and transom are at right angles to the keel form, cut the notches for the chines in all the frames, including the transom frame, but not into the transom planking. Clamp a batten in place before cutting the chine notches so as to insure getting a true curve and the proper bevels. The rabbet should now be cut in the stem to the proper depth for the thickness of the side planking to be used. The chines can be fastened to the frames and stem and stem knee with 1¾" No. 10 screws; the chines do not need to be notched into the stem.

After checking to make certain that the side frames are plumb, notch the sheer battens into the frames and fasten with 1½" No. 8 screws.

(TO BE CONTINUED)

How the keelson, keel, chine, batten, knee, and planking fit together at transom





THE SECRETS  
OF MAKING A  
PROFESSIONAL-  
LOOKING

# Photo Montage

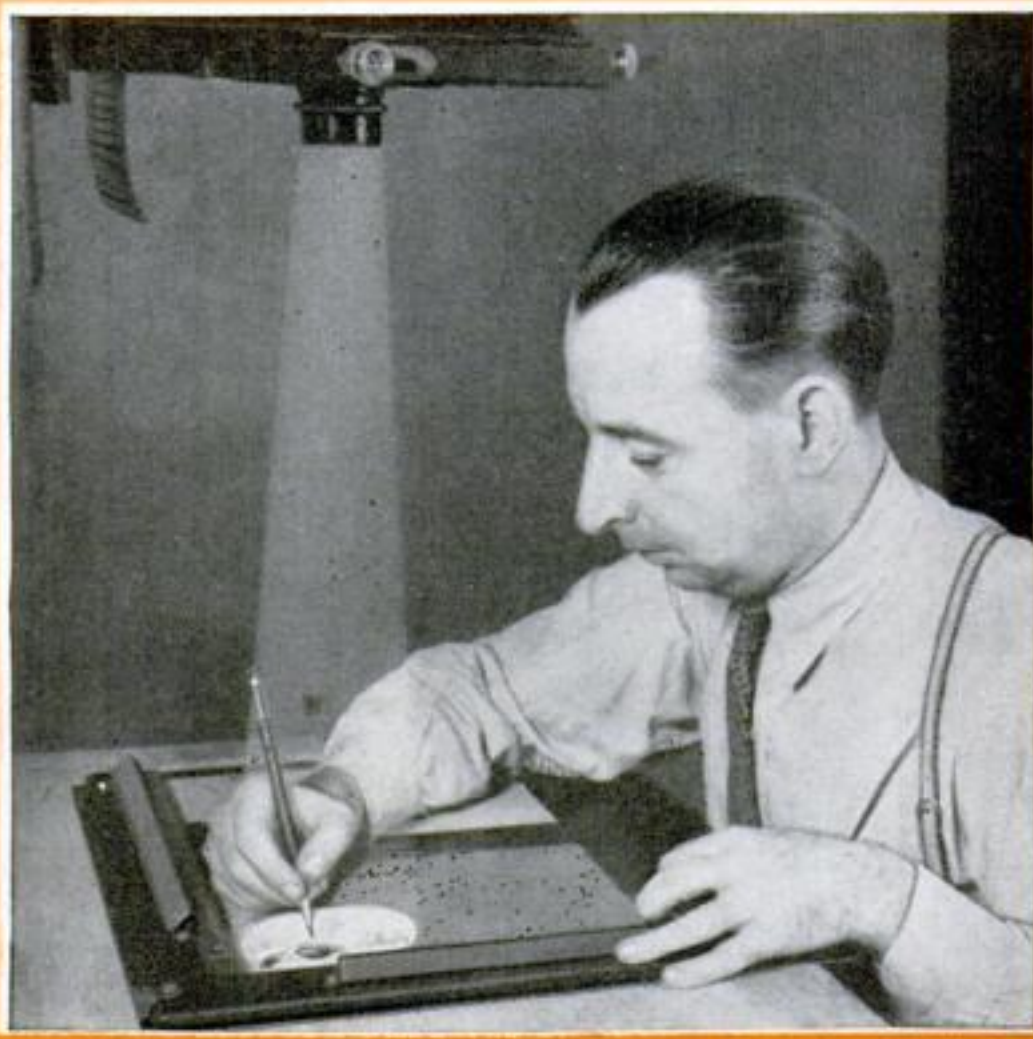
By  
FRANK  
CAPORAEAL

Left, a popular type of montage is one showing several poses of the same person. Below, the first step is to project each picture individually and sketch in its outline as a guide

**P**HOTO montage is a novel method of presenting a picture story. It is actually a picture having a number of component parts, each subject fading or blending into another. Related subjects should, therefore, be selected. The most satisfactory results may be obtained by the use of projection printing, that is, enlarging.

The first step is to make the negatives for the pictures to be used. Since these must all be printed on the same sheet of paper, endeavor to maintain uniformity in exposure time and development period.

A simple method of obtaining the approximate position and size for each picture in the finished montage is to make a series of tracings from the projected image. Put a piece of





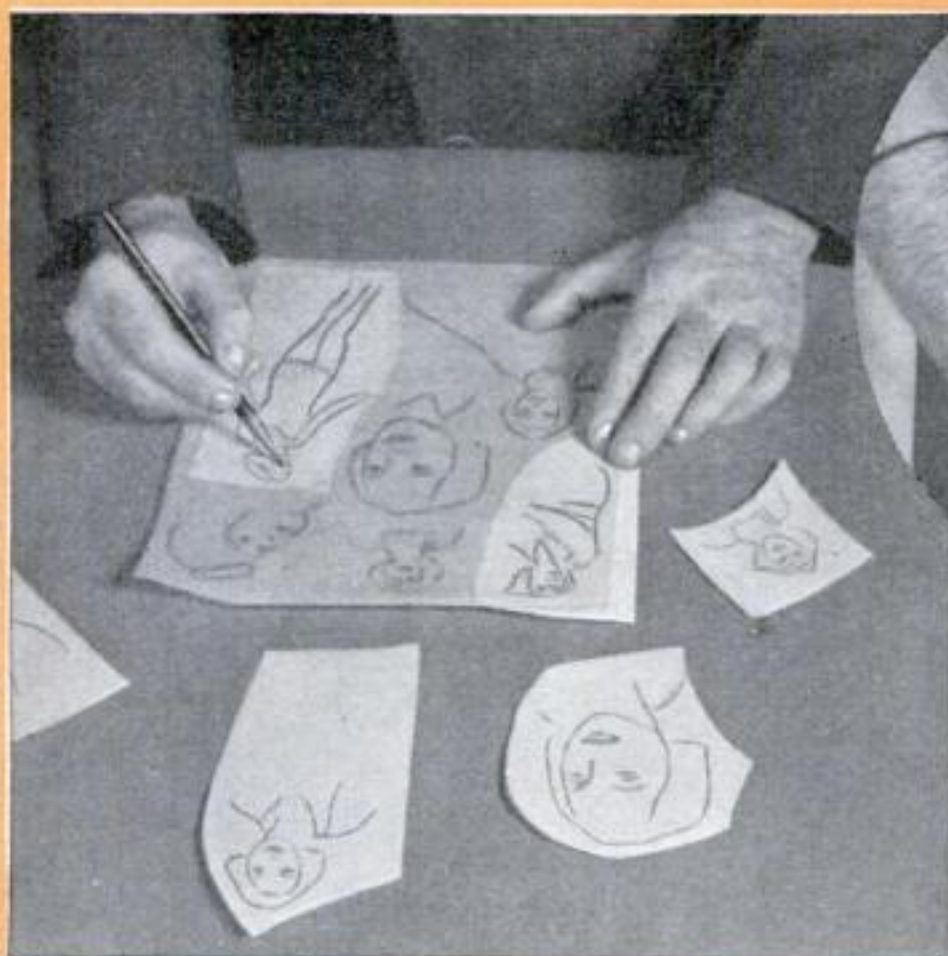
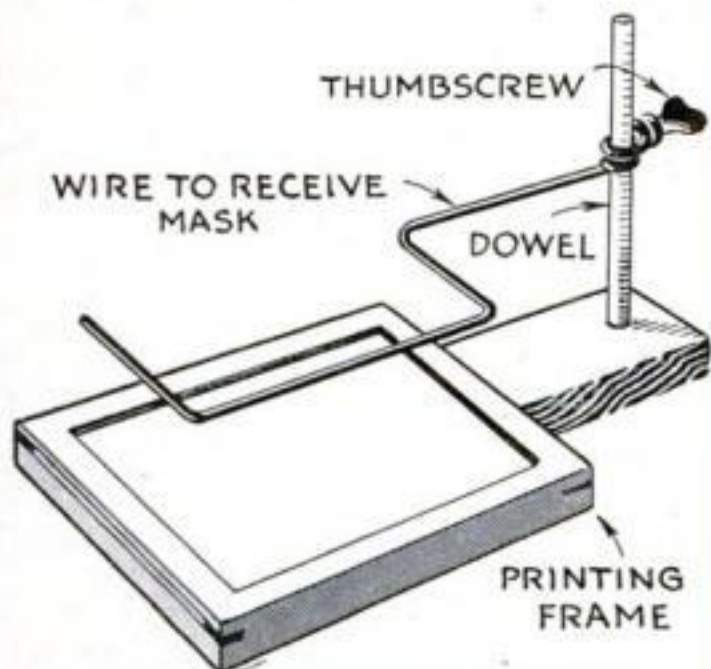
ordinary white paper of the desired size in the enlarging easel, then project one negative and focus it in the desired position. When the image is sharp and about the right size, trace the image with a pencil. This procedure is followed until all the pictures of the montage have been traced.

If, after the sketch is made, it is desired to change the layout, it is necessary only to cut out each part of the rough drawing and from these make another tracing after arranging the individual sketches in the desired positions.

With the roughly sketched layout as a guide, you are ready to do the actual printing. As only one picture at a time may be projected through the enlarger, it is necessary to mask the remainder of the projection paper while each negative is being exposed. The mask is cut from dark cardboard. The blending

lines in the montage usually fade from light to dark, therefore, a fixed aperture in the mask is impractical. To obtain the necessary variation in blending, a number of pieces of black paper are cut in various shapes with irregular, saw-toothed edges and laid on the mask as illustrated.

To support the mask between the lens and the enlarger easel, a stand may be made as shown from a block of wood about  $\frac{3}{4}$ "



The mask, which rests on a wire support, is cut from dark cardboard, and strips of black paper with saw-toothed edges are laid on it to form the openings. At left, tracing the rough sketches to form the master layout



by 3" by 6", drilled to receive a dowel near one end. The cross member on which the mask rests is merely a piece of wire bent as shown. One end is wound around the dowel and looped to take a thumb screw for positive adjustment.

The next step is to place each negative in turn in the enlarger, focus it to fill the desired space, arrange the mask to suit, and make the exposure. During each stage of focusing and masking, the actual printing paper must, of course, be protected from the light. There are various ways to do this.

If a printing frame or similar type of paper holder is used, the paper can be kept in it throughout the entire process. In this case, the sketch is mounted on cardboard of a size to cover the printing frame, and the cardboard is removed only when an actual exposure is to be made. The same method may be used if an adjustable easel is available. The paper remains in place, and the sketch is removed before each exposure.

Another method, which is more tedious

but quite foolproof, is to remove the paper after each exposure and place it in a light-tight box until the next picture has been focused on the sketch. In all cases, of course, the position of the sketch and the paper must remain exactly the same, otherwise the successive images will not be projected in the right place and in proper relation to each other. This cannot be emphasized too strongly. It is best to mark the bottom of the projection paper so there will be no danger of reversing it. The paper and layout sketch must be kept in perfect register.

When all is ready and the first negative has been focused, a test for exposure time and paper grade is made with a small strip from the package to be used. Another test for time is made, if necessary, before each subsequent exposure. Finally the print is developed and fixed in the usual way.

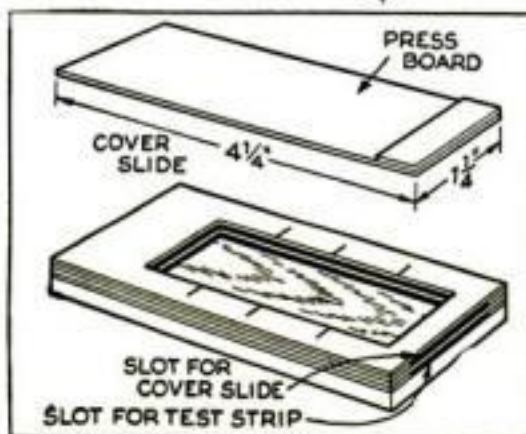
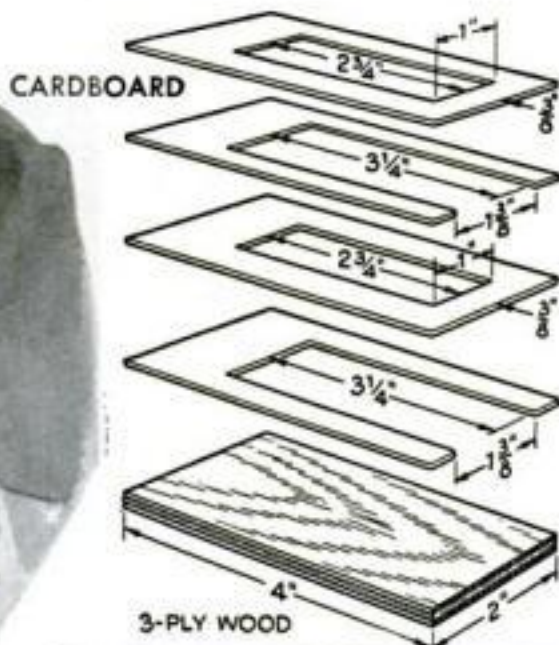
Great care must be exercised to obtain perfect exposures each time, because one bad exposure will necessitate the repetition of the entire process.



## A Timesaving Holder for Test Strips

CONSIDERABLE time can be saved in determining the correct exposure for projection prints if use is made of the simple test-strip holder illustrated above. It is designed for test strips  $3\frac{1}{2}$ " by  $1\frac{1}{4}$ ".

In use, a test strip is slid into the lower slot, and the cover slide is slid into the upper slot. The enlarger light is then turned on and the holder moved around on the enlarger easel until the exact portion of the projected image to be tested appears on the cover slide. The enlarger light is turned off, and the cover slide is pulled out far enough to expose the whole test strip, but not entirely out of the holder. Once more the enlarger light is turned on, and at the end of each time interval, the cover slide is pushed about one-fourth of the way in.—J. A. A.



## How to Flatten Curled Prints

GLOSSY prints can be flattened by placing them separately between the pages of a large, limp magazine and rolling the magazine tightly around a 2" diameter mailing tube in the direction opposite to the curl of the prints. Hold the roll with rubber bands.—W. C.

## Mounting a Timer for Easy Reading

A WOODEN wedge under an ordinary darkroom timer will tilt it at an angle so that the dial can be read more easily from either a standing or a sitting position. Bolt the clock to the wedge.—NATHAN SPERBER.





## PRINT DOPES

[PHOTOGRAPHY]

**Noncurling.** Prints may be prevented from curling by coating the back with the following solution: 32 oz. water,  $\frac{1}{4}$  oz. gelatin, and a drop or two of oil of cloves. Coat the prints while still damp.

**Oil coating.** The following will increase the apparent scale of tones into the blacks and make the print appear richer: 2 parts poppy oil, 2 parts turpentine, and 1 part copal varnish. Use about 10 drops to an 8" by 10" print. Rub the mixture with absorbent cotton which has been slightly dampened with turpentine, then rub off with dry cotton. Set aside for two or three days to dry.

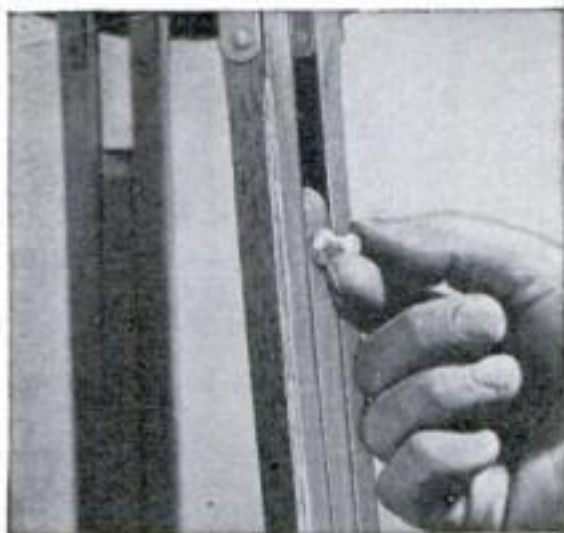
**Wax coating.** While there are many formulas for wax coatings for prints,

ordinary floor wax seems to be as good as any. Either paste or liquid wax may be used. Apply very little and use plenty of "elbow grease" in polishing.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

## Drawer Knobs Aid in Adjusting Legs of Wooden Tripod

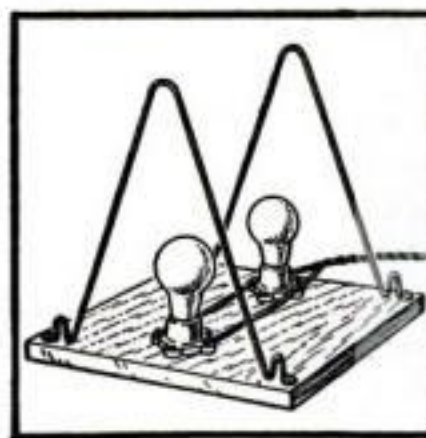


THE leg extensions of many wooden tripods are difficult to grasp in order to adjust them for height. It is a good idea to drill the top section of each extension and attach a small drawer knob, or at least use an ordinary metal push pin.—K. M.



## Metal Disks Stop Down an Enlarger Lens

IN ENLARGING thin negatives it is advisable to stop down the enlarger lens so the exposure will be sufficiently long to allow accurate timing and any necessary dodging or other manipulation. When an enlarger has no diaphragm, two or three stop-down disks with holes of various sizes can be made from thin, stiff metal so they will fit inside the lens barrel. Simply remove the lens, fit in the desired disk, and put the lens back in place.—L. B. ROBBINS.



## Rack Supports Ferrotypes Tins over Lamps for Rapid Drying

Two ferrotypes tins supported as illustrated over two 50- or 75-watt lamps will serve for drying prints rapidly. The prints should be well blotted before being placed on the rack to dry, and it is a good idea to rub an absorbent cloth over the back of the prints after they are placed on the tins to remove excess moisture and prevent spots.





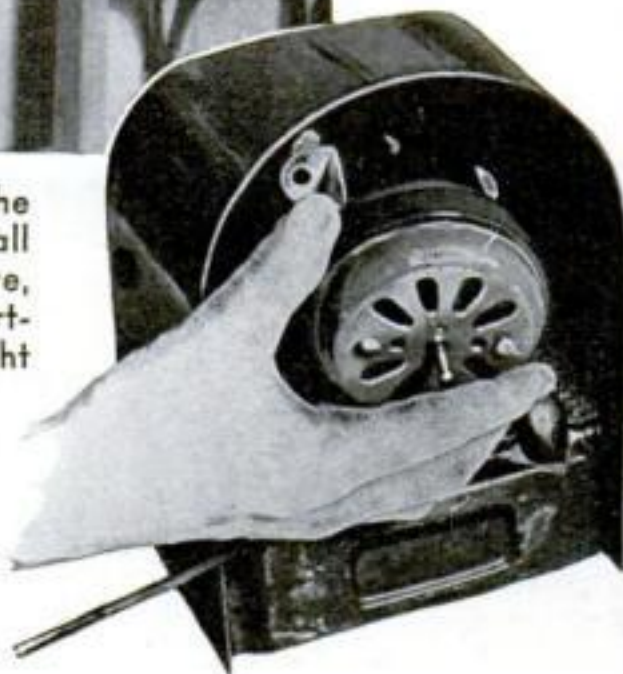
## Cooling System for Darkroom Built from Old Auto Heater

MANY darkrooms become almost unenduringly hot when used for any length of time, but this can be overcome by installing a cooling system made from an automobile heater. First, the unit must be adapted for house current by replacing the old fan with a small household fan, the blades of which may have to be cut down to fit the case. The fan can be mounted by shaping two strips of lightweight metal as shown. One end of each strip is bent to fit under the clamp which goes around the motor; the other end is bent and drilled to fit the bolts used on the case.

The whole unit is fastened to an upright with a switch placed conveniently at hand. Water is led in through a hose from a faucet, and another hose carries the overflow into a sink or other outlet. As the water flows through the radiator, the fan draws the air through the bottom of the unit and forces the cool air out through the grill. A suitable old automobile heater can often be obtained at an auto junk yard.—B. J. BRONSON.

Right, replacing the old fan with a small household fan. Above, mounting the converted unit on an upright

The new fan is held by means of metal strips, as at far right



## NEGATIVE INTENSIFICATION

[PHOTOGRAPHY]

Generally speaking, the only negatives worthy of intensification are underdeveloped ones. Underexposure cannot be rectified. The following formula is excellent because it is capable of considerable variation in the degree of contrast. However, it contains a very poisonous chemical and should be mixed and used with the **UTMOST CAUTION**.

Monckhoven's Intensifier (E.K. In-1)

Potassium bromide	$\frac{3}{4}$ oz.	or	23 grams
Mercuric chloride (VERY POISONOUS)	$\frac{3}{4}$ oz.	"	23 grams
Water to make	32 oz.	"	1 liter

After the negative has been very well washed to remove all traces of hypo, bleach in this bath until white. Wash thoroughly. Then redevelop the negative to blacken it in one of the following: (1) A 10-percent sulphite solution. (2) Any standard developer such as D-72, diluted 1 to 2. (3) A 10-percent ammonia solution. These give progressively greater density in the order listed.

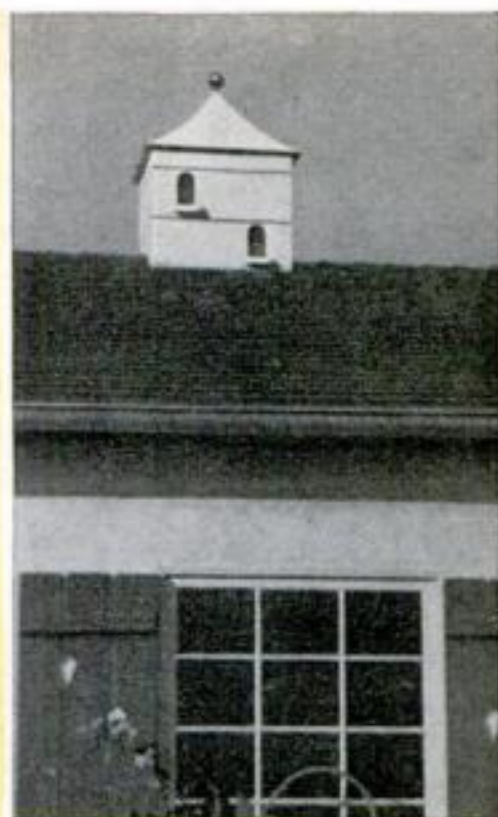
**Note:** In professional work, especially for line copy, a second solution is often used in the Monckhoven formula, but it contains cyanide, which is generally unavailable for amateur use and far too poisonous for any but the most careful professional handling.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

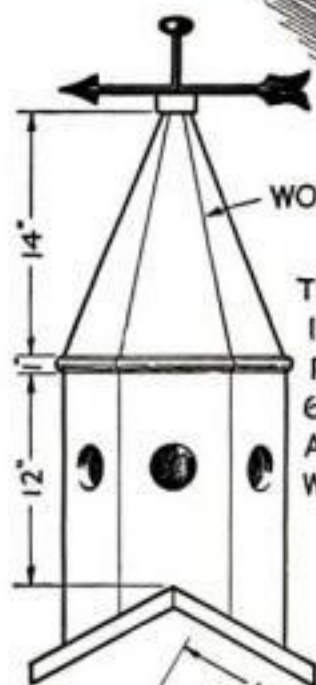
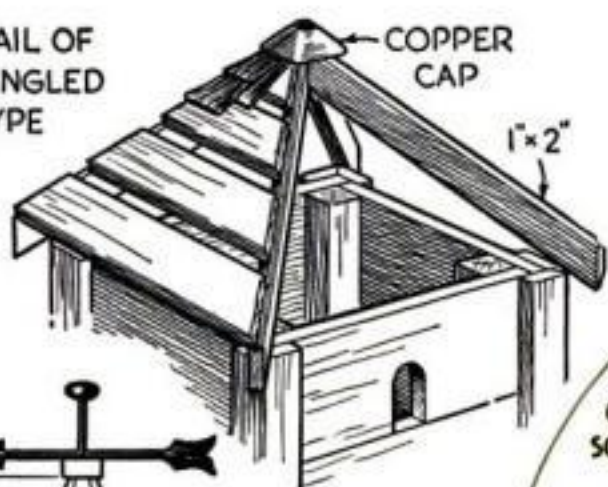


# Cupolas for Feathered Friends

FAR more decorative than the ordinary run of boxlike bird houses are these miniature cupolas. They make effective ornaments on the roof of a garage or any other small building.



DETAIL OF SHINGLED TYPE

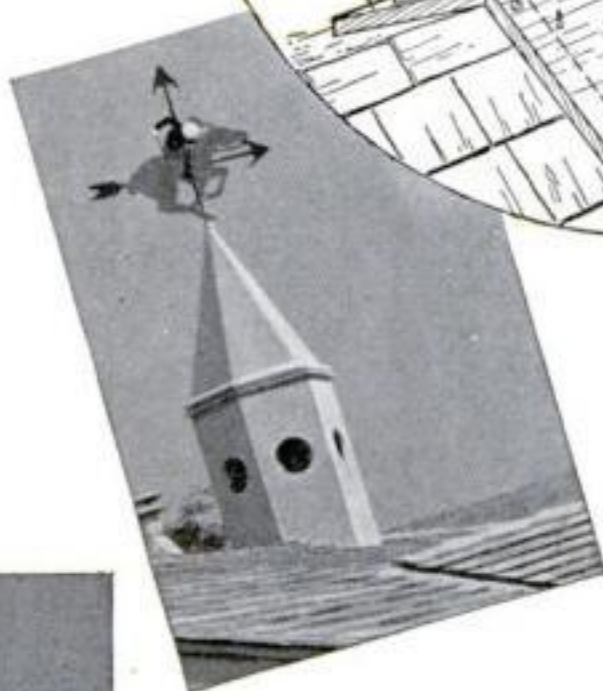


WOOD ROOF

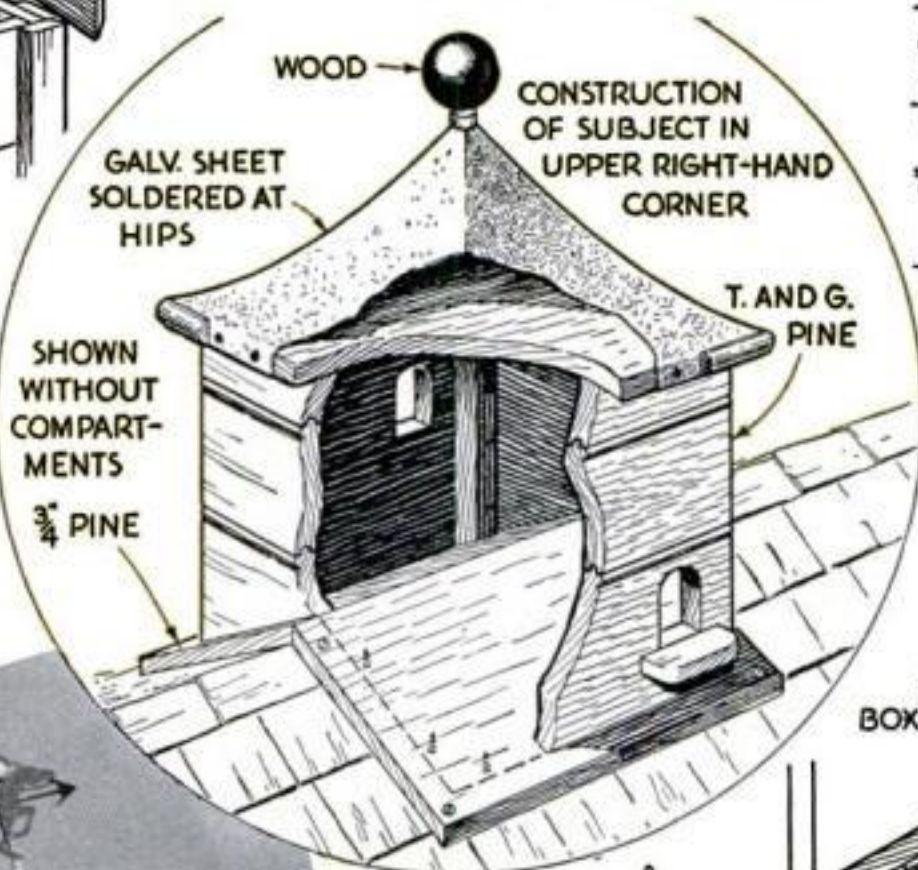
THIS DESIGN IS BUILT OF PINE. MITERED 60° ON THE EDGES AND ASSEMBLED WITH CASEIN GLUE



1/4" OUTDOOR PLYWOOD PARTITIONS



THIS SIDE ONE-PIECE OUTDOOR PLYWOOD, TWO OTHERS, T AND G. PINE



WOOD

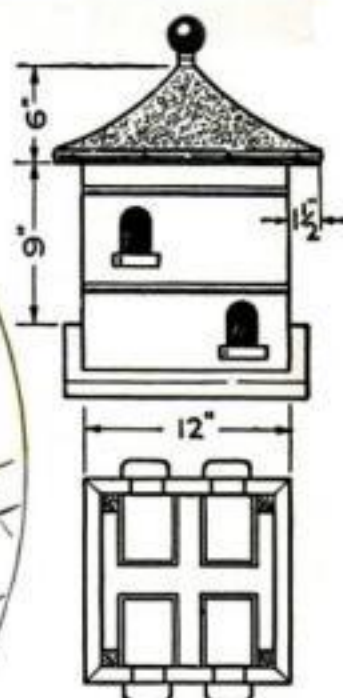
CONSTRUCTION OF SUBJECT IN UPPER RIGHT-HAND CORNER

GALV. SHEET SOLDERED AT HIP

SHOWN WITHOUT COMPARTMENTS

3/4" PINE

T. AND G. PINE



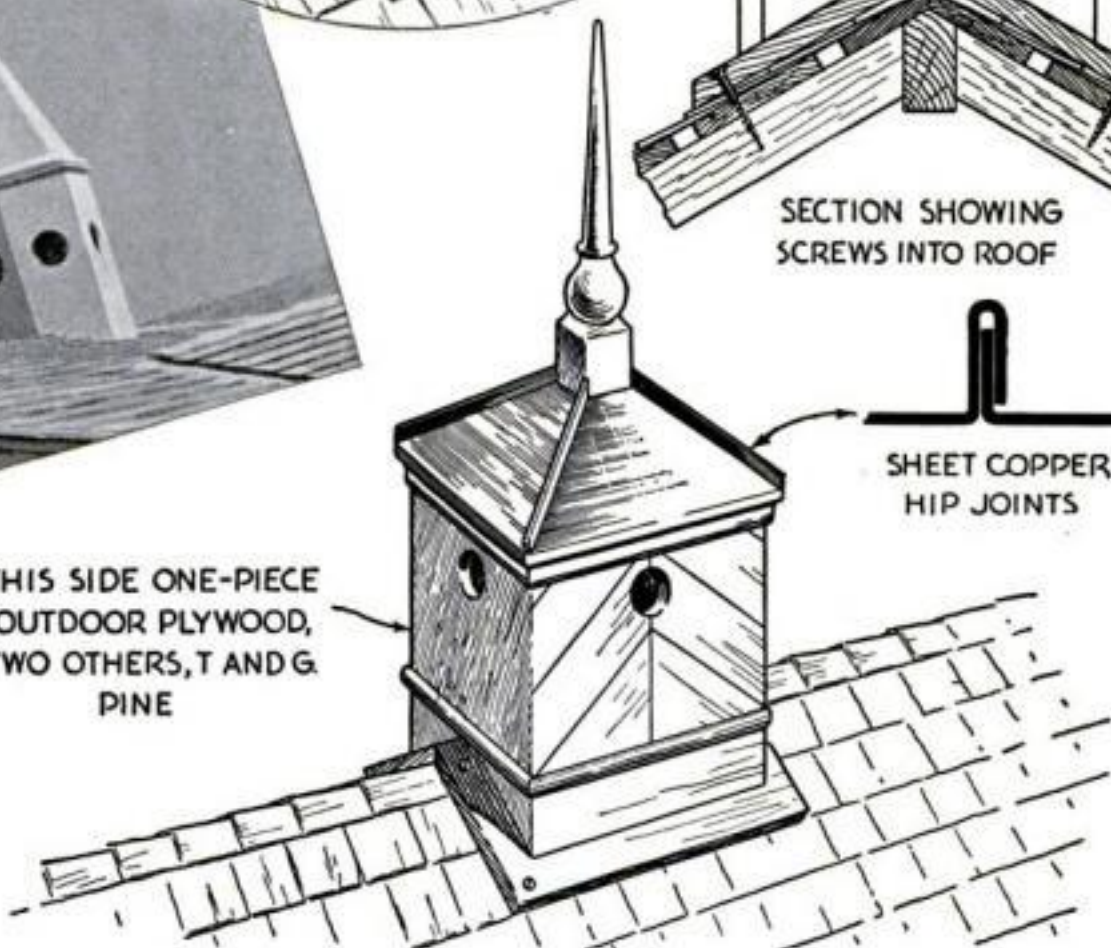
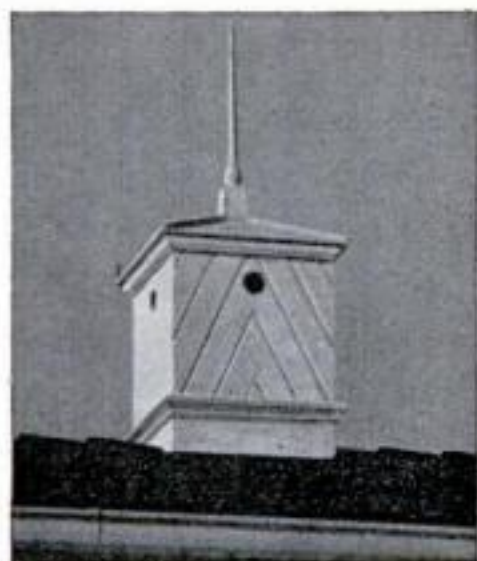
SECTION SHOWING BOXES FOR COMPARTMENTS



SECTION SHOWING SCREWS INTO ROOF



SHEET COPPER HIP JOINTS





# Cutting a Jib

TO FIT YOUR  
SAILBOAT

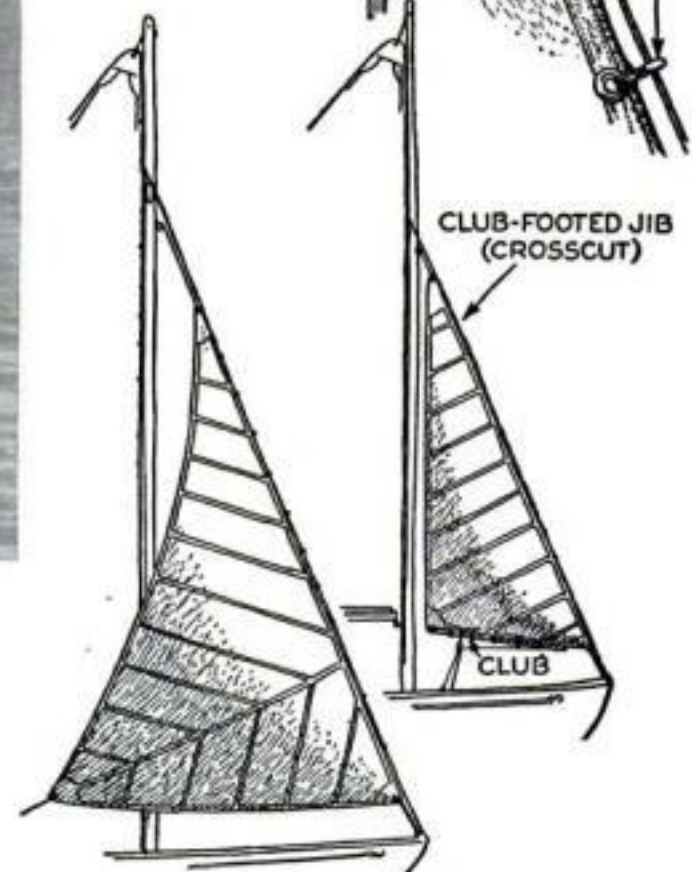
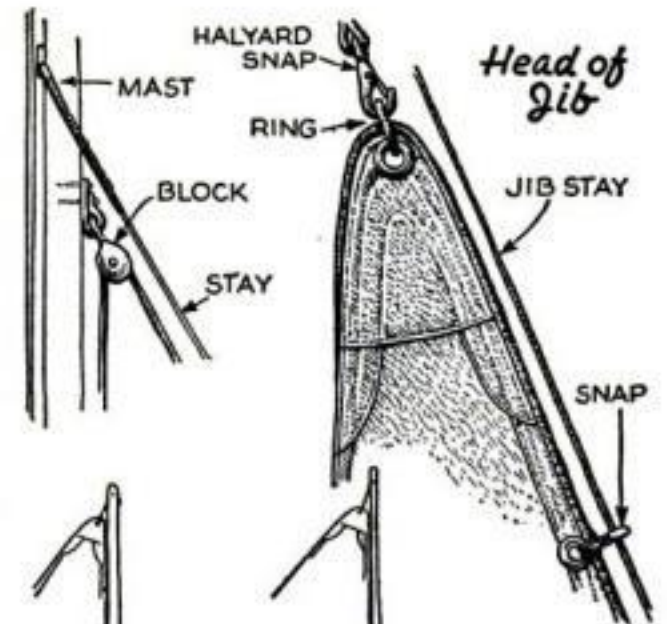


By WILLIAM HARNDEN FOSTER

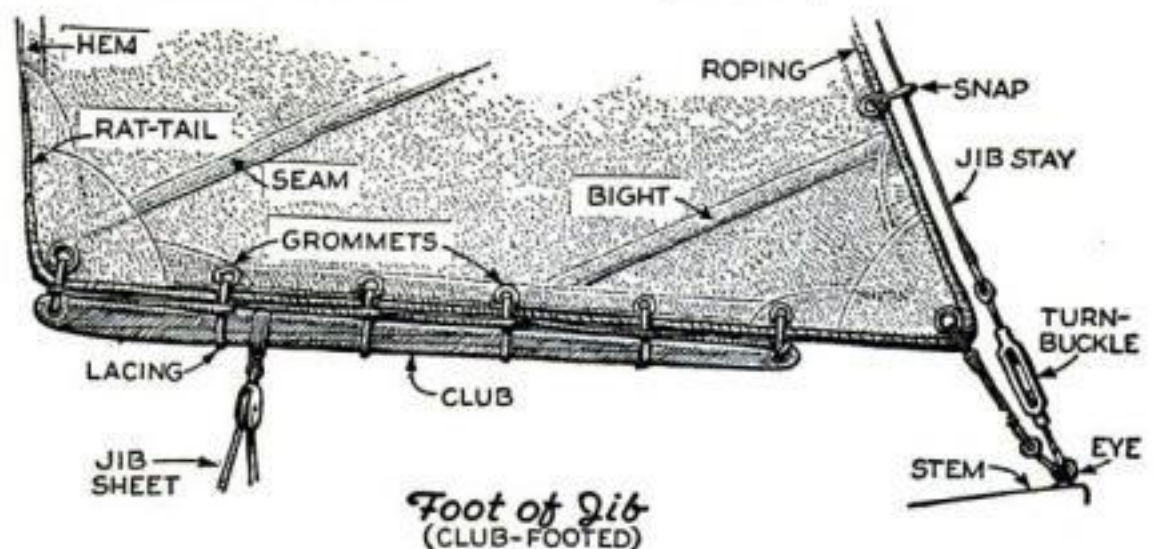
**S**MALL boat jibs may be divided into two general classes: the loose-footed, overlapping jib, and the club-footed type. The former is used in combination with a high, narrow mainsail to give the boat increased power as in racing. The latter is used with a proportionately larger mainsail; it adds less to the drawing power, but helps greatly in its steering balance.

In both types the luff is attached to the jib stay with snaps. The jib halyard snaps to a grommet or ring at the head, since jibs are not equipped with headboards. The leech of both types is cut straight, but a curve is given the luff.

But here the similarity ends.



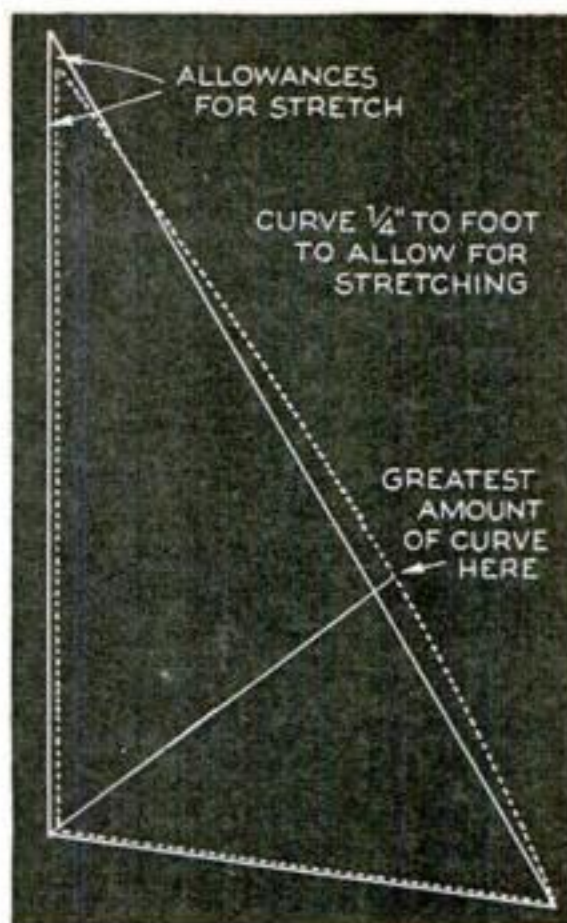
LOOSE-FOOTED OVERLAPPING JIB  
(MITERED)



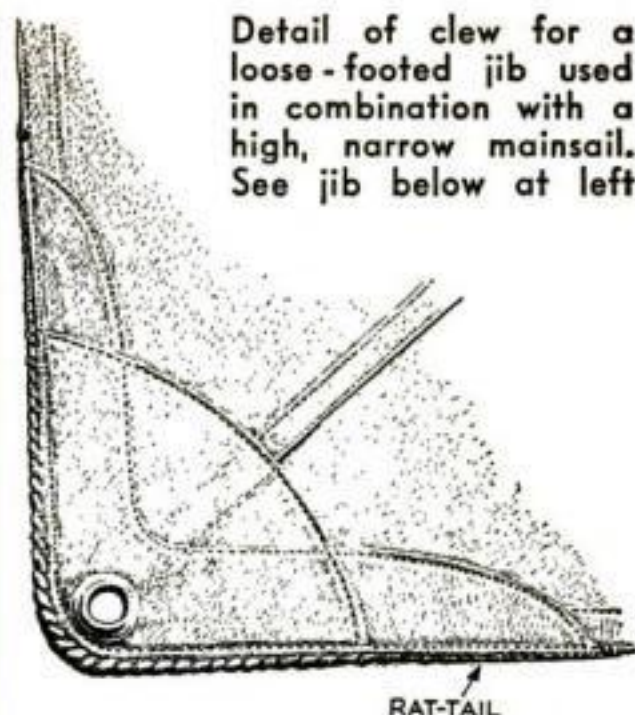
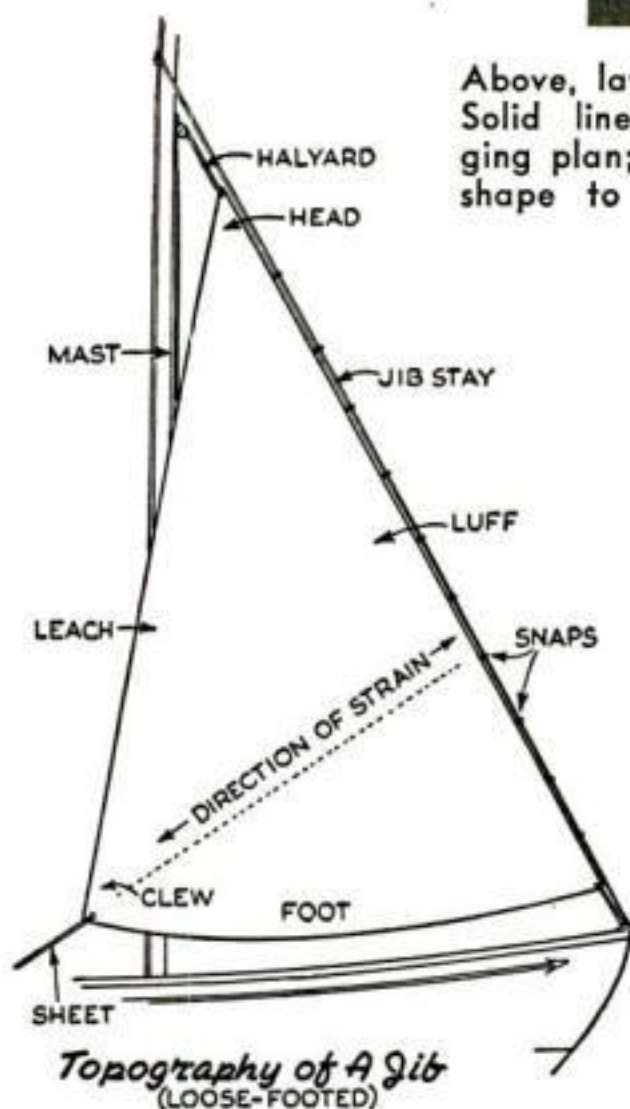
Foot of Jib  
(CLUB-FOOTED)



Many readers who made mainsails for their boats by following the instructions in Mr. Foster's article "Well-Fitting Sails for a Small Boat" (P. S. M., July '39, p. 160) asked for additional information on jibs. This is given in the accompanying article. Reference should be made to the previous article for general methods of cutting, sewing, reinforcing, and roping small sails.



Above, laying out a club-footed jib. Solid lines are dimensions of rigging plan; dotted lines represent the shape to which sail is finally cut



The overlapping jib trims from the clew and for that reason is usually rounded on the foot. Because the strain from the clew corner is great, this type of jib is cut with the canvas running in two different directions to add strength. On the upper half the weave

runs at right angles to the leech, while on the lower half it runs at right angles to the foot. Jibs cut in this way are called mitered.

The club-footed jib has a club or boom lashed to the foot, which is cut straight. Because the sheet is attached to the club, the strain is distributed, and the sail is made crosscut with the weave running at right angles to either the luff or the leech. This is a matter of looks and may depend on the shape and cut of the mainsail.

A club-footed jib is roped over the head, down the luff, and along the foot, but not on the leech. The loose-footed jib is roped over the head, down the luff, but not on the foot. However, it is roped around the clew.

There is no rule for the amount of curve to be given to a foot of a loose-footed jib, but in both the loose-footed and club-footed types the amount of round on the luff or stay edge should be about  $\frac{1}{4}$ " to the foot and is greatest opposite the line of the pull of the sheet.

In making big jibs, especially mitered, professional sail-makers taper seams to gain certain flat or hard areas.

## "Basket" Built from Stones Holds Growing Flowers

SMALL stones embedded in concrete form this ornamental flower "basket" for the lawn. The handle should be reinforced with lengths of heavy wire or small rods, and similar pieces can be used to strengthen the sides. An ordinary basket filled with earth might well be used as a core around which to plaster the stiff concrete. It need not be removed. Low flowering shrubs or vines make a nice arrangement. The basket shown at the right was designed by John Grady, Ludington, Mich.—W. E. B.





# Little Helpers for Your

Robert Jaacks, the young man shown below, has already set up his first machines and is planning to add some accessories as soon as his monthly budget of \$15 permits. In the meantime he is busying himself with projects that will train him in the use of his new circular saw, jointer, and scroll saw.



Smoothing the edges of a band-sawed furniture leg with a sanding drum in the lathe. The drum is built of metal and rubber and cased with a sandpaper sleeve, which is held by expansion



Cutting tubing on the circular saw with an abrasive disk (guard thrown back to show work). Right, Jaacks planes a stop-chamfer on his new 4" jointer





# Woodworking Machines

By EDWIN M. LOVE

*What accessories are commonly used by the amateur craftsman with his circular saw?*

He usually cuts his wood roughly to length and width before finishing it accurately. Since he often shifts from cutting across the grain to cutting with it, most home-workshop saws are equipped with combination blades, which cut well at any angle.

If quantity production is attempted, however, time may be saved by ripping all pieces with one set-up and making another set-up with a crosscut saw for cutting to length. Smoother cutting across the grain, or mitering, is assured with a novelty saw, which resembles an outside cutter for a dado head; and for extra-fine work, the hollow-ground novelty blade, which has no set, is best.

A dado head is the thing for grooving drawer fronts and sides to carry the bot-

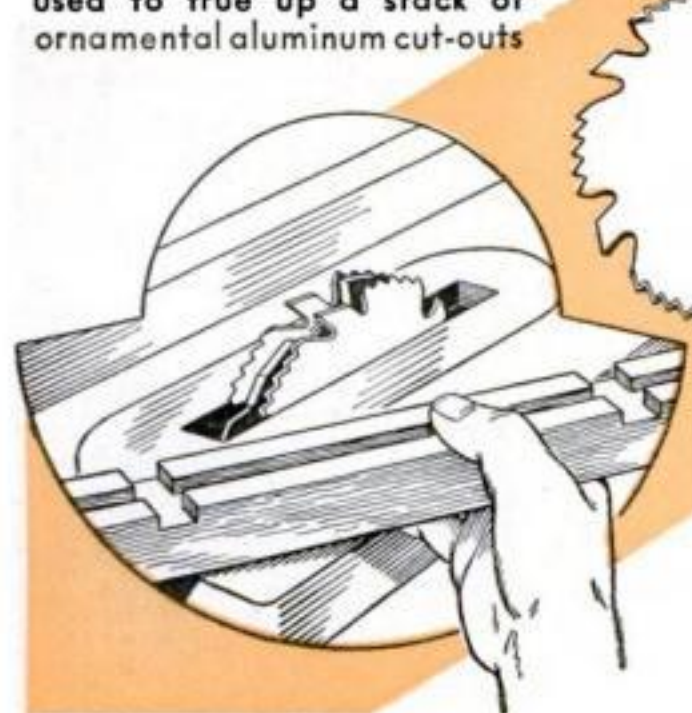


A file in the scroll saw is used to true up a stack of ornamental aluminum cut-outs

## PART VI OF A NEW SERIES FOR BEGINNERS



Four accessories are shown at left. First is a file for use in the scroll saw; then two saw blades, one quite wide; finally, a small sanding drum

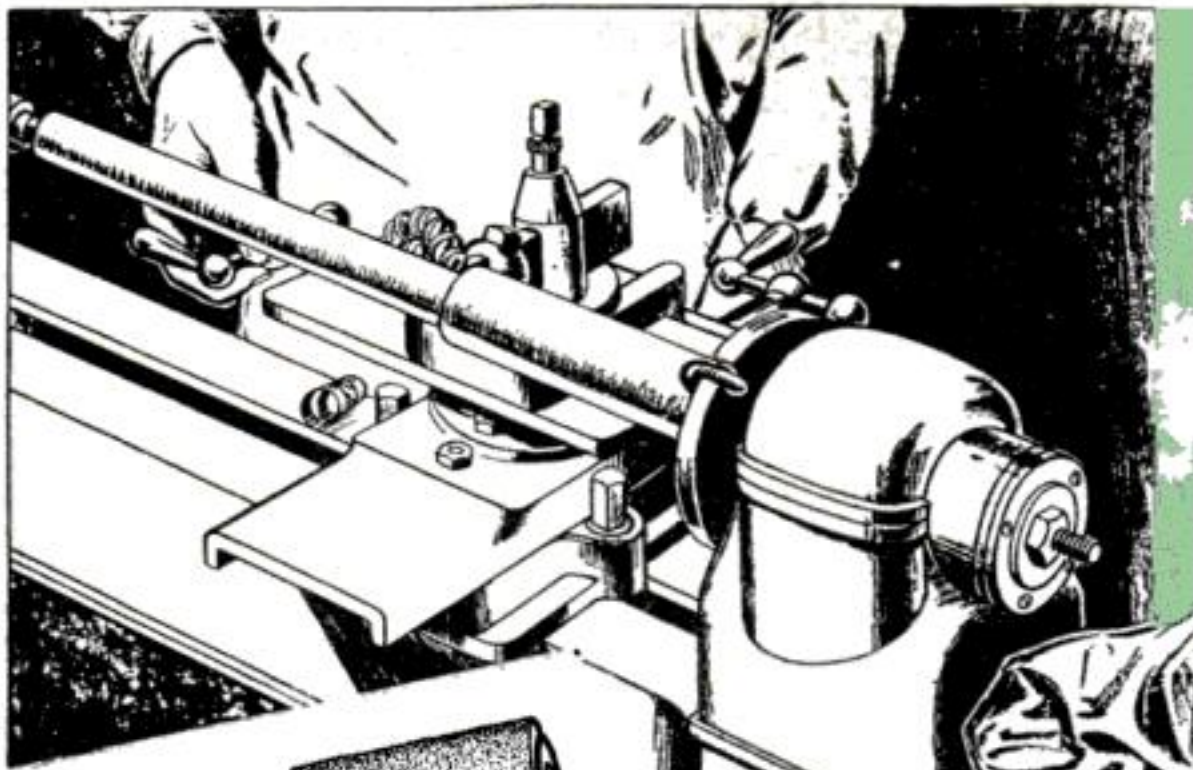


Cutter

A dado head with its cutters and chipper blades. Right, molding head and cutters







Left, compound lathe rest for metal turning. In panel at left, sanding drum, arbor for grinding and buffing wheels, drive center, cup center, chuck, plain center, sanding disk, and two faceplates. Below, set-up for metal spinning



*Drum Sander*



*Arbor*



*Drive Center*



*Cup Center*



*Chuck*



*Plain Center*



*Disk*



*Faceplates*



Wood-turning tools. Reading from top, skew chisel, spear-point, parting tool, round-nose chisel, and three gouges



toms, as well as for certain rabbeting, cutting tenons, and similar work. The outside cutters singly, or in combination with each other and the inside chipper blades, allow grooving from  $\frac{1}{8}$ " to  $\frac{13}{16}$ " wide.

A molding head will put a neat molding on the edge of a library table or a graceful edging on a round stand. Such a head

A plain tool rest for wood turning and a right-angle tool rest, which is very useful for faceplate work





carries three cutters of chosen pattern, securely locked in place with screws.

### ***When are abrasive cutting wheels required?***

Used like a circular saw blade, an abrasive disk will cut special material with neatness and dispatch. It will slice through a bar of hardened tool steel amid a shower of sparks in a fraction of the time required for hack-sawing a like bar of mild steel. Thin-walled tubing, sheet metal, copper rods, tile, brick, and many other materials hard to cut by hand offer little resistance to the proper abrasive disk. The type ordinarily used is 3/32" thick, bonded with synthetic resin.

### ***Can band-sawed edges be smoothed by machine?***

The outstanding accessory for machine sanding is the sanding disk, used on a lathe in conjunction with a tilting table. The disk screws on the end of the spindle, or clamps on an adapter with a set screw; and whirling at high speed, it cuts with precision and ease. Roughly sawed pieces of wood are trimmed to the line in a trice.

### ***Don't sanding disks wear out sandpaper quickly?***

The "mileage" of the garnet paper used is surprisingly great. When the paper is finally worn out, scrape it off, run the disk at medium speed, and apply cement in the form of a stick, like belt dressing. Stop the disk; then press on the new paper with the

hands, and the tool is ready to use again.

A cousin of the disk is the sanding drum, built of metal and rubber, and cased with a sandpaper sleeve, which is held by expanding the rubber by tightening a nut. It can be used in lathe or drill press for smoothing inside curves where the disk cannot be used. Similar appliances, flat on one side and round on the other, are made for use in a scroll saw. Both disk and drum are efficient for dressing metal edges provided the garnet facings are replaced with emery.

### ***Can files be used in machines?***

Files are made for use in scroll saws to smooth metal edges, either single plates or stacks of sheets for duplicate work. They are just right for filing dies. Larger files, broken off to a convenient length and ground a little around the tangs, serve effectively for smoothing curved wood edges.

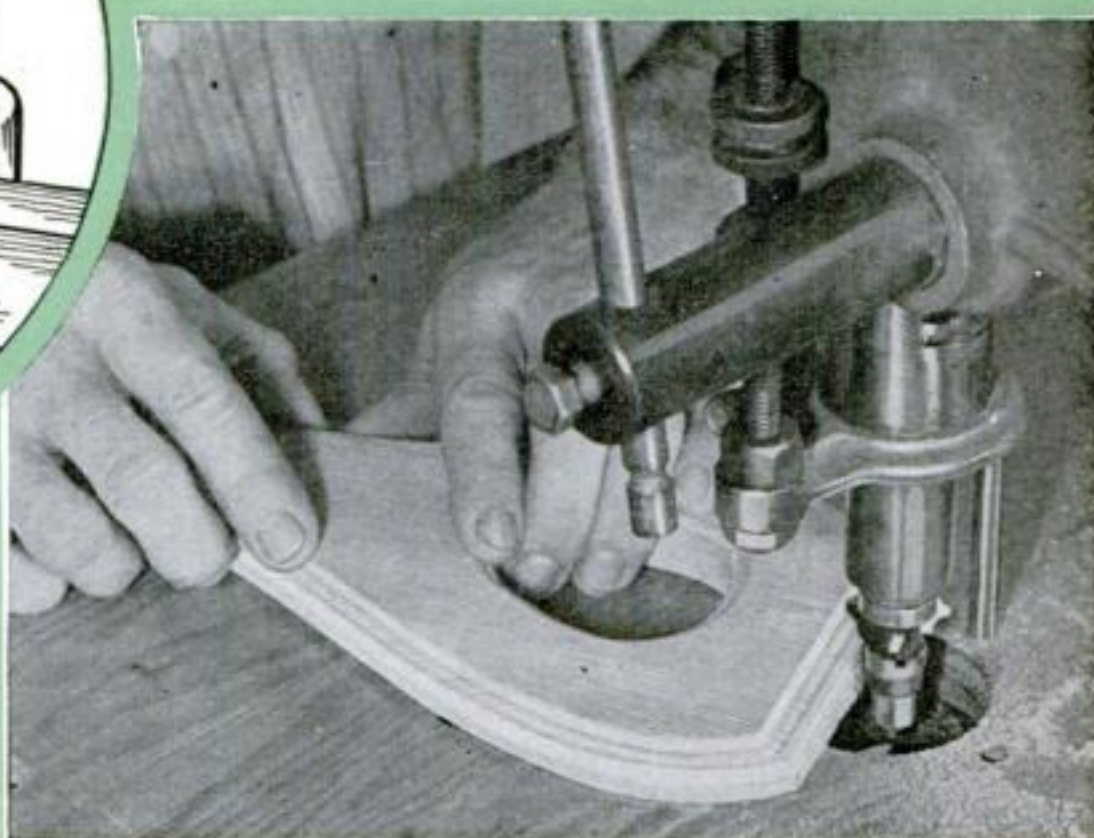
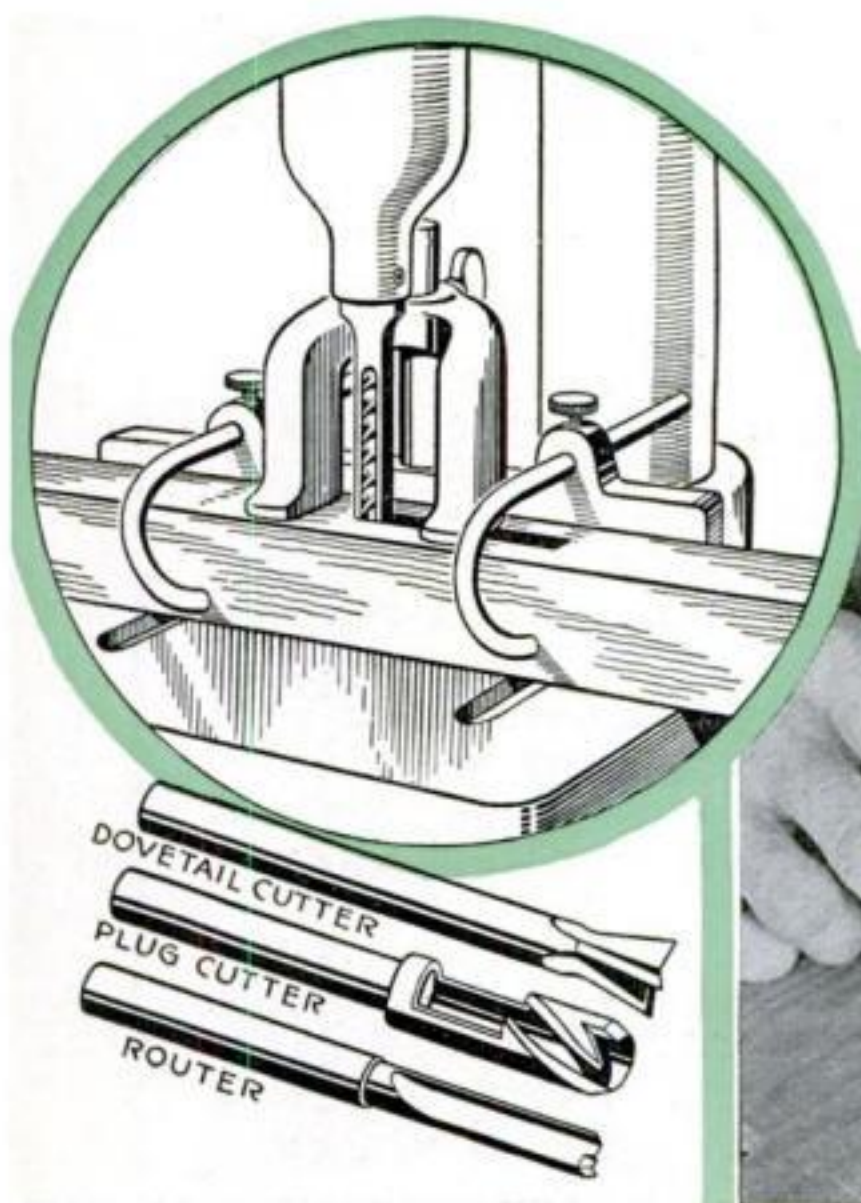
### ***How is drilling done on a wood-turning lathe?***

A drill chuck can be used on the spindle, with the work backed by a faceplate on the tailstock. If a small center hole needs to be bored in turned work, the chuck is put on the tailstock and the work revolved.

### ***What is a compound tool rest?***

This is a metal-turning attachment. It has a base slide moved with a screw for feeding the tool across the work (the cross feed) and a second slide above that for feeding at any angle (the compound feed). A small bit, clamped in a tool holder, is carried in a post at the top. Swiveling

At left, how a drill-press mortising attachment is used. Below, a modern high-speed drill press can be used, with suitable cutters, for shaping





is provided for, and all screw handles are calibrated in thousandths of an inch. Bolted to the lathe, the rest is handy for all sorts of small metal-turning jobs. It does good work in plastic novelties, such as saltcellars, napkin rings, and small trays. Fairly long rods can be turned if care is taken in resetting the tool rest after it has cut to the limit of its extension.

#### What is a mortising attachment?

It is a bracket for holding hollow square chisels, inside which a bit rotates, and is used in the drill press. The bit bores a hole, the chisel trims it square. As many square holes are sunk as are needed for the length of the mortise.

#### How is shaping managed on a drill press?

A cutter of the desired shape, usually three-winged, is mounted on an adapter with suitable washers or collars to limit the depth of cut. Held in a chuck, the cutter whirls at highest speed. A fence can be used at times.

#### Are there any accessories for the jointer?

Jointers have their accessories built in, so to speak. Their job is to surface narrow material, straighten edges, make rabbets, and do similar work.

#### What accessories have band saws?

Fences and miter gauges can be used, and slow drives for metal cutting. It is easy to

Sawhorse with special roller for supporting the end of boards being ripped on the saw



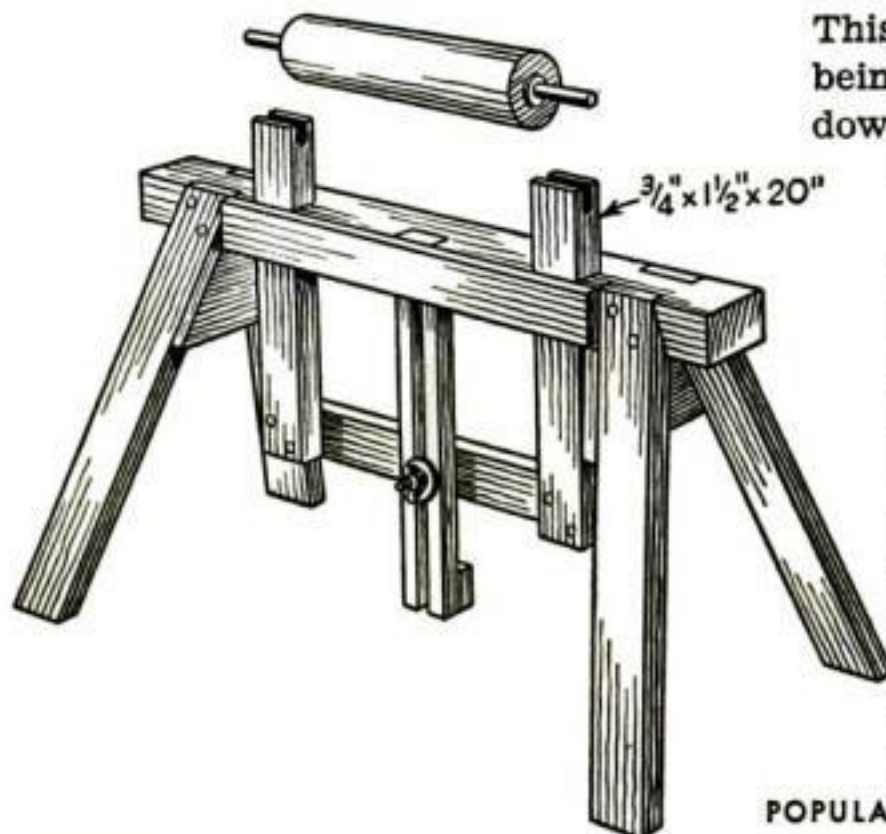
rig a clamp with the miter gauge, with a weighted cord over a pulley, to feed the work against the blade. A large metal bar can then be clamped and left to cut while the mechanic occupies himself with another task.

Some of the band saws on the market are equipped with auxiliary guides which permit the use of a narrow sanding belt instead of the usual band-saw blade. One guide is for straight edges, the other is for curved work.

(TO BE CONTINUED)

### ROLLER SUPPORT FOR RIPPING

#### [WOODWORKING]



This device supports long boards while being ripped on a circular saw. It slides down when not in use. The roller lifts off and can be laid away in a drawer.

1. Make four strips of hardwood as shown, and screw three together to form a U.
2. Slot the fourth strip  $5/16$ " wide to form a clamp slide.
3. Notch the sides of the U into the sawhorse, and notch the slide centrally between them. Retain the frame with a strip nailed to the horse.
4. Fit the crossbar with a  $1/4$ " carriage bolt, washer, and wing nut.
5. Turn the roller from 3" by 3" stock, and use spikes for pivots.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



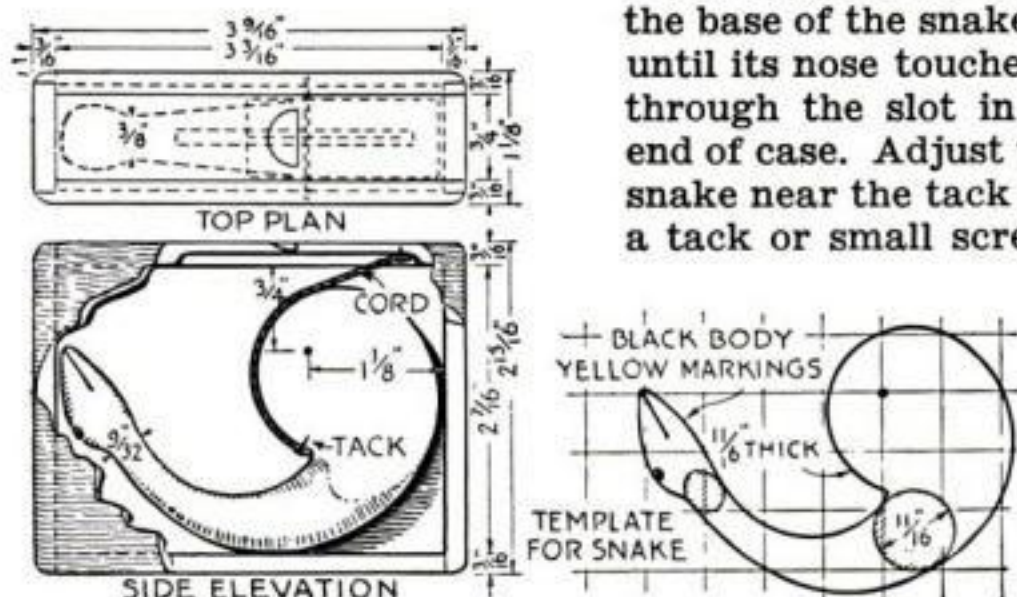


## A Wooden Snake-in-the-Box Trick

IF YOU like practical jokes, a lot of fun may be had by leaving this little case where anyone who sees it will be sure to pick it up. As the lid is opened, a snake rears its head.

The case should be made of  $\frac{3}{16}$ " hardwood, assembled with glue, and given a good finish. The sliding lid should fit snugly for the first  $\frac{1}{8}$ " of pull, then freely for the balance of the way. The holes for the pin may be hidden by a monogram or other ornament. The snake, shown on  $\frac{1}{2}$ " squares, is roughed out of  $\frac{11}{16}$ " poplar or white pine with a jig saw and then carved. It will look quite realistic if colored black with a yellow stripe along the back, white throat and neck, and yellow eyes with black pupils.

Make sure that the snake turns freely. Attach the cord at the base of the snake's neck and roll the snake out of the case until its nose touches the top of the lid. Now work the cord through the slot in the underside of the lid and over the end of case. Adjust the lid so that the forward end clears the snake near the tack by about  $\frac{1}{8}$ " and then fasten the cord to a tack or small screw in the slot.—WARREN H. WOLFE.



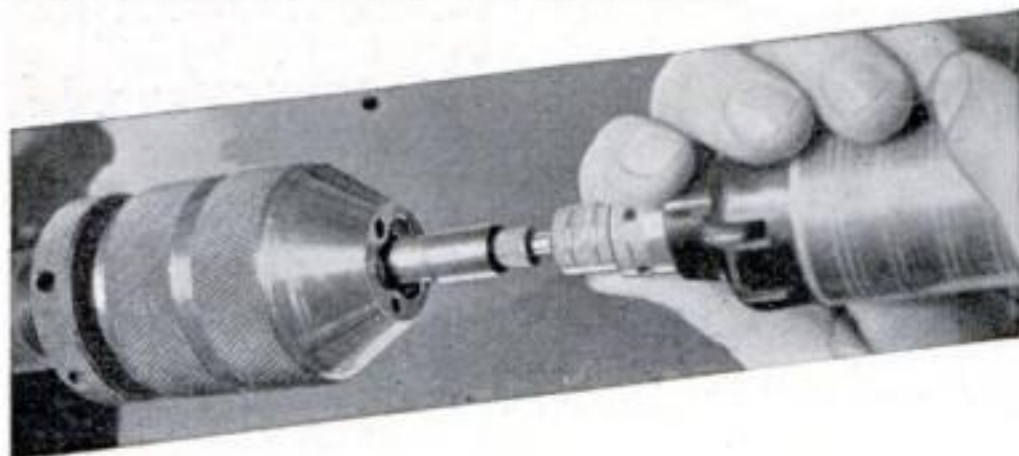
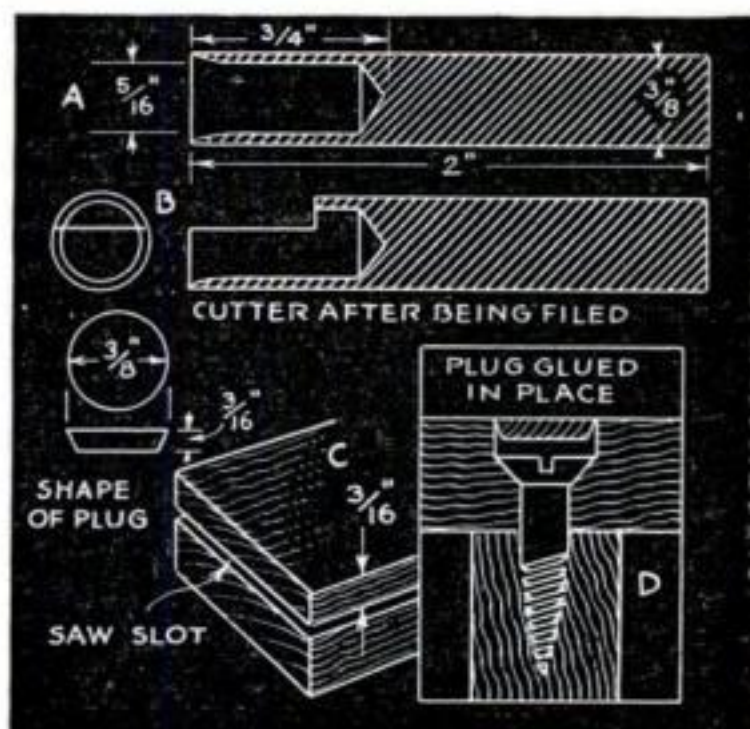
As the slide slides open, a cord draws out the snake

## Screwhead Plugs Quickly Cut with Drill-Press Tool

A PLUG cutter for cutting plugs to cover the heads of flathead wood screws which are to be sunk below the surface of wood can be made from  $\frac{3}{8}$ " diameter tool steel about 2" long. Drill a  $\frac{5}{16}$ " hole  $\frac{3}{4}$ " deep in one end. Place the stock in the chuck of a drill press or lathe and, using a hand grinder with a pointed abrasive wheel, grind the inside to a taper as at A. After grinding, file off approximately one third as at B. Then temper, and the cutter is ready for use.

Plugs are usually cut on a drill press from a piece of wood about  $\frac{3}{16}$ " thick. This is easier if the wood is first slotted with a saw as at C.

Bore a  $\frac{3}{8}$ " hole  $\frac{3}{16}$ " deep for each screw, then bore the pilot holes. After driving the screw, put a little glue on a plug and press it in place as at D, keeping the grain of the plug in alignment with the other wood.—W. T. BAXTER.



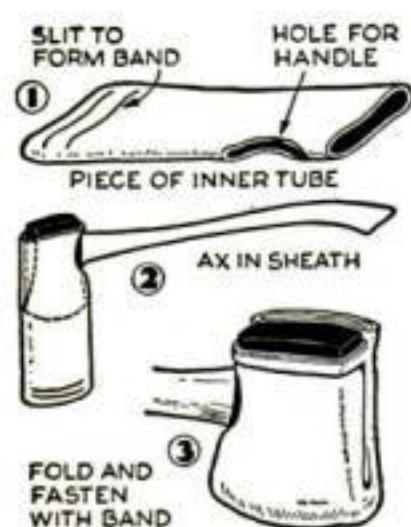


## Eye Dropper Holds Small Steel Balls

BY FITTING a short piece of rubber tubing over the tip of an eye dropper, you can make an efficient holder for handling and assembling the small steel balls of ball bearings. Squeeze the bulb, press the tube end against the bearing, and release the pressure. The vacuum created will hold the bearing.



## Heavy-Duty Ax Sheath Cut from Inner Tube



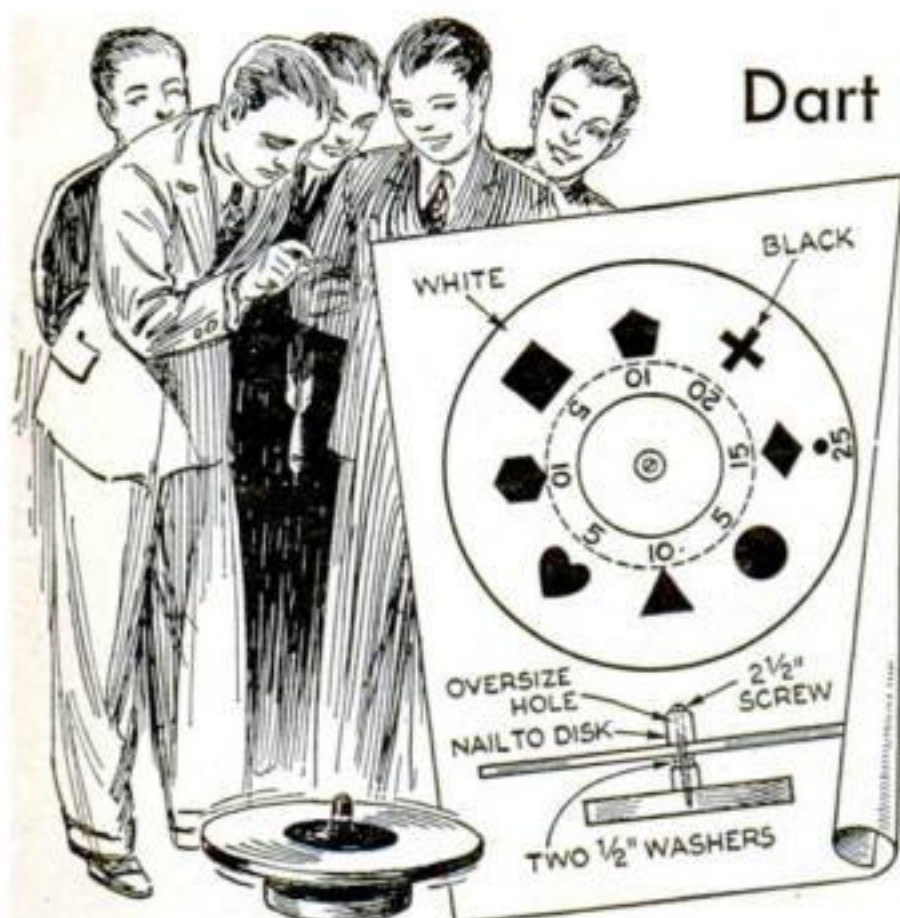
FOR an ax sheath, I've never found anything more satisfactory than the one shown in the accompanying sketches. It was cobbled out of an old piece of heavy inner tube after I'd lost a combination metal and leather sheath on a hunting trip. Cut the tube twice the length of

the ax blade and make the hole for the handle as indicated. Draw the blade inside the piece of tube, which is then folded over the cutting edge and fastened with a rubber band that is part of the inner-tube sheath itself.—JOHN EDWIN HOGG.



## Ironing Board Cut Down for Typewriter Table

A COMMON ironing board of the style shown may be easily converted into a practical folding typewriter table. It is necessary only to saw off the lower ends of the legs, reducing the table height to 24", and shorten the length of the board to about 30". In some cases the metal braces may have to be taken off and replaced a little higher up.—J. MODROCH.



## Dart "Bombs" Whirling Target

ONLY one dart is used in this new game, called "bomber's luck," and it is dropped on the target, which is a spinning 12" disk of fiber wall board placed on the floor. Eight designs are painted on the disk as shown, and it is mounted on a block so that it will turn freely.

Whirl the disk with the knob—not too fast—and hold the dart to the tip of the nose while standing erect. Then let go before the disk stops. Each player has three chances, and after five rounds the score is added to decide the game. If the dart sticks inside the inner circle, which is 4" in diameter, another shot is allowed. A suitable dart can be bought, salvaged from another dart game, or made, as preferred. The point should be very sharp.

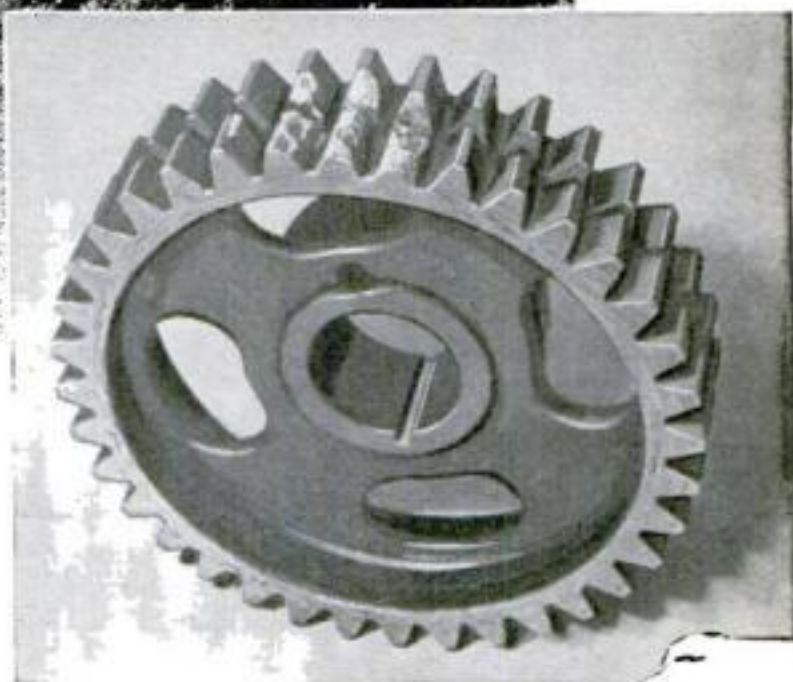




# NEW SHOP IDEAS



## Repairing Cast Iron WITH THE OXYACETYLENE TORCH

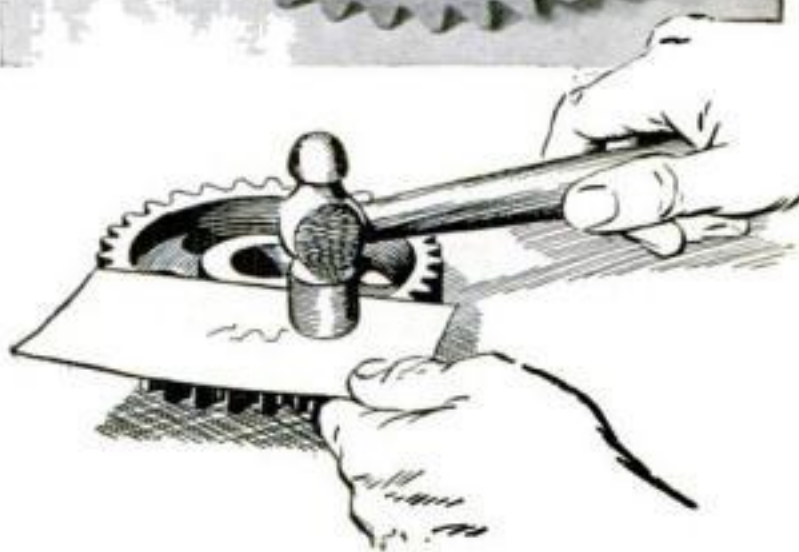


**W**ELDING cast iron is frequently necessary in the small shop. However, castings that have been exposed to flame, such as grate bars or stove parts, or have been in salt water for a long time are difficult, if not impossible, to weld.

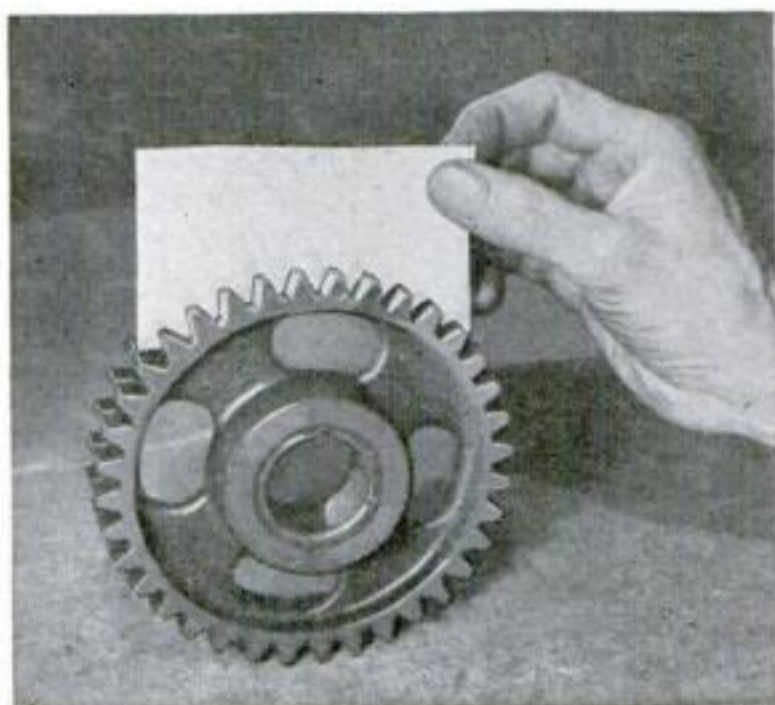
To prepare a casting for welding, clean it thoroughly. If it has become saturated with oil, dry the broken parts with a torch until no more oil soaks out. Should the piece ever have been brazed, clean off every trace of brass. If the broken part looks crumbly, it must be chipped away.

A good flux is essential, and enough of it should be used to keep the weld bright at all times. The work must be placed so the welding may be done straight down. In welding, you will notice bright specks floating on the weld and also an occasional gas pocket. The bright specks must be kept skimmed off the surface with the filler rod. Gas pockets are removed by heating the spot and digging into it with the filler rod.

The illustrations at right show how a cast sprocket



Cardboard is placed over some of the good teeth and tapped with a hammer as a guide for cutting out a template



After the broken teeth are built up by welding, they are dressed to the correct shape by using the template



was repaired. The sprocket was cleaned, and the broken teeth were chipped to the solid metal. Next, a piece of cardboard was placed over several of the undamaged teeth and tapped with a hammer to provide a template to which the welded teeth could be dressed.

A No. 2 tip was used, and the filler rod was  $\frac{1}{4}$ " cast iron. The sprocket was warmed up all over until a drop of oil placed on it would catch fire. The heat was then concentrated on the first tooth. As soon as the surface started to melt, the slag was scraped

off, a little flux was applied, and a layer of filler rod was melted across the tooth. The process was repeated until the tooth was built up slightly larger than the undamaged ones. Each tooth was built up in this manner. The final step was to dress the teeth to size. A hack saw was used to cut off the excess metal, and the finishing was done with a file.

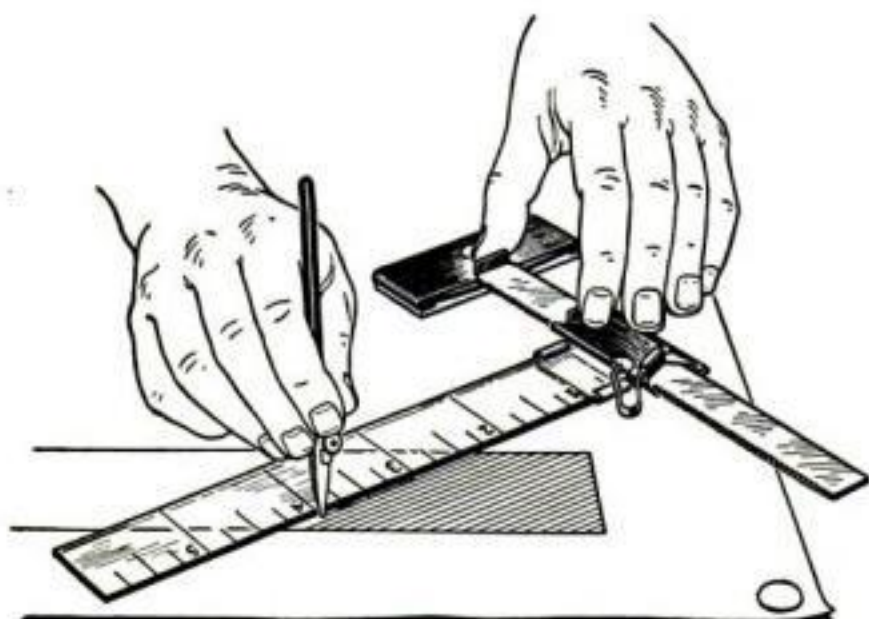
If the teeth are less than  $\frac{1}{2}$ " apart at the rim, remove the broken ones, build in the space solid, and cut the teeth out of the new, solid metal.—WILLIAM C. CHENEY.

## Draftsman's Spacing Guide Uses Old Hack Saw

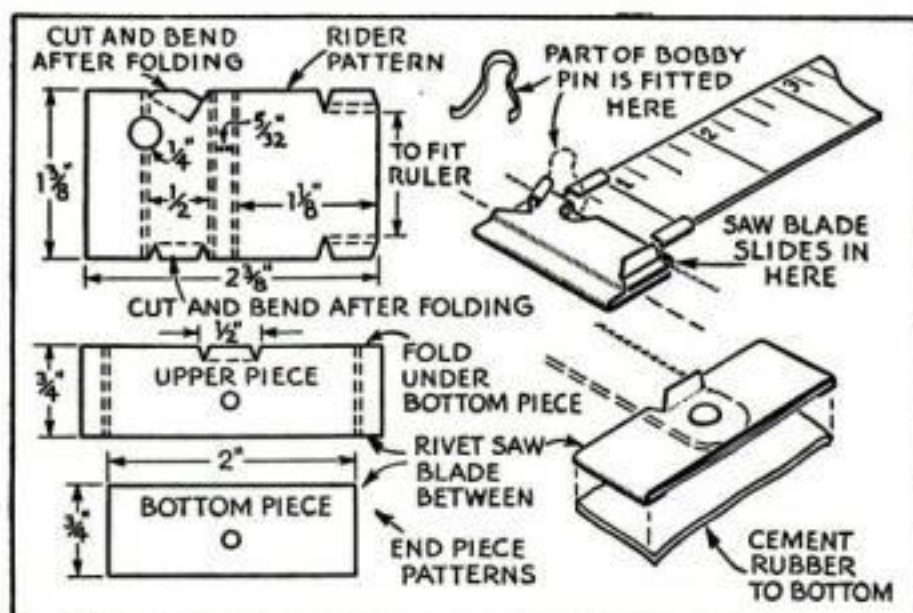
CROSS-HATCHING lines can be spaced accurately  $\frac{1}{32}$ ",  $\frac{1}{16}$ ",  $\frac{3}{32}$ ", or  $\frac{1}{8}$ " apart with a ruling guide and automatic spacer built around a 32-tooth hack-saw blade. The set is ground out of the teeth so that the blade will slide freely. Part of a bobby pin serves as the spring and pawl that rides along the teeth. The guide is a transparent

rule, and the rider is formed from sheet metal bent around the saw blade. The  $\frac{1}{4}$ " hole in the rider through which the bobby pin spring engages the teeth of the blade is drilled before bending the metal.

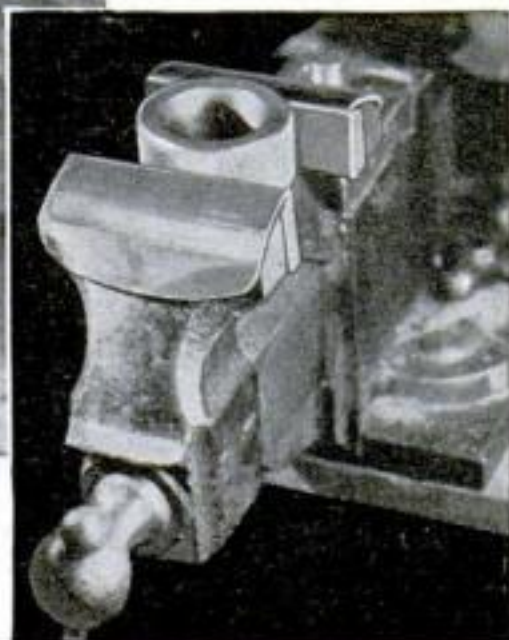
Two pieces of metal are cut and riveted over the hole end of the blade, and a piece of rubber cemented to the underside of the stationary part thus formed to prevent slipping while in use.—R. A. C.



A small spring clicks against the hack-saw teeth as thumb and finger grips are pressed



Bending one of the copper facings. At right, the jaws in use

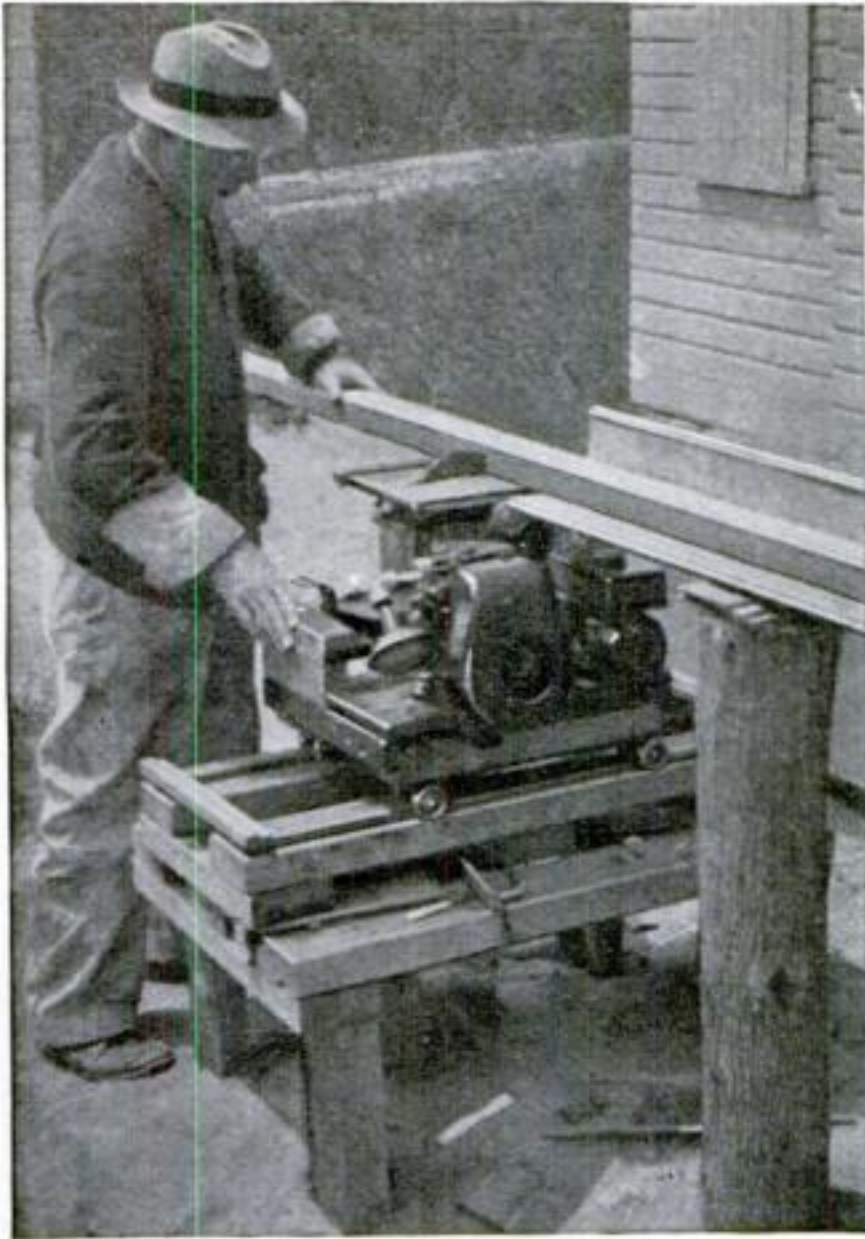


## Copper Vise-Jaw Facings Made from Old Half-Tone Plates

SOFT copper vise jaws to prevent damage to polished surfaces or knurled, threaded, and other easily marred work, can be made from discarded copper half-tone printing plates, obtainable from a printing shop. A piece of cardboard is clamped in the vise, bent over, and cut out for use as a template for scribing the copper, which is then cut with a hack saw, clamped in the vise, and hammered to shape with a rawhide or other soft hammer. Make them so they are easily removed when not needed, and mark them front and back so they can be replaced properly.—C. W.



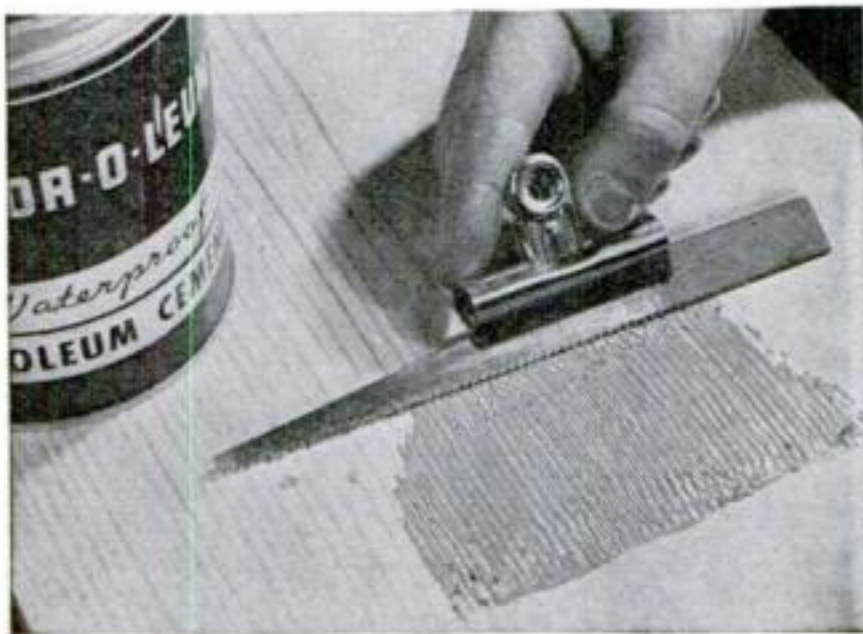
# Portable Cut-Off Saw Mounted on Skate Wheels



Long boards for construction work are cut off by rolling the entire saw forward on wooden tracks

## Hack-Saw Blade Spreads Linoleum Cement

LINOLEUM cement or other adhesive can be spread over large surfaces by using a hack-saw blade with a spring metal paper clip for a handle, as shown below. A shorter length of blade can be riveted to a handle for spreading glue on wood joints.

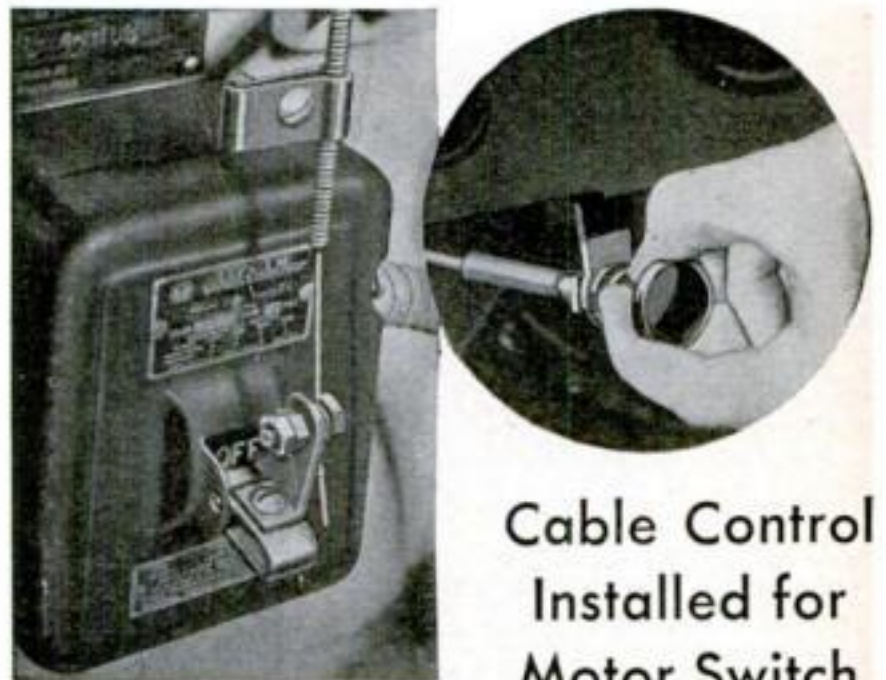


In the absence of a regular toothed spreader for heavy cements, an old hack-saw blade may be used

A **TIMESAVING** cut-off saw with which to cut lumber to length for construction purposes may be made by mounting a small circular saw and its motor on a base under each corner of which is fastened a pair of roller-skate wheels. A bench is then constructed of 2" by 4" or 2" by 6" lumber with tracks attached to guide the rollers. The tracks are merely 1" thick strips of wood trimmed just wide enough to make a snug fit between the skate wheels. The saw slides on the tracks as illustrated.

A table to hold the boards while being sawed is made of two 1" by 6" boards nailed together at right angles and mounted level and square with the saw blade on two posts set into the ground. Rapid cutting is done by rolling the saw back and forth. When angular cutting is to be done, an extension may be mounted at right angles to the table to hold the board that is being sawed. Besides cutting off, the saw can still do every other kind of cutting for which it was intended.

In this case the machine is a 6" circular saw, and the motor is a 1/2-h.p. washing machine unit. The gasoline motor is advantageous for this work because it can be used where electricity is not available and also because of its economy, extra power on hard pulls, and governor control.—C. L. SAWYER.



Cable Control Installed for Motor Switch

MOTOR switches on machines are often difficult to reach from the operating position. If it is impractical to change the location of the switch, it is usually possible to use a wire control of the type sold by auto-accessory dealers. These cables should be installed with gentle curves, and the ends must be securely fastened with suitable clamps. The cable illustrated is on a power saw that has a rising-and-falling table with a 45-deg. tilting motion, yet the switch works perfectly in all positions.—JOHN M. AVERY.



# Inch Marks on Clamps Aid in Setting Them

LONG wooden or metal gluing clamps of the type illustrated can be set quickly to any size opening by marking an inch scale on the bar in a contrasting color of lacquer applied with a small brush. The clamps shown have been marked off in inches by means of a series of short lines, and then numbered every 5".



These cabinetmaker's bar clamps are marked off in inches so they can be set quickly to any size



## Spring Wiper on Blade Cleans Paint Scraper

WHEN a wide putty knife is used for scraping paint or varnish from wood or other surfaces, the accumulated film may be removed quickly and easily if a spring wiper is attached to the blade as shown. The wiper consists of a length of clock spring to which a sheet metal crosspiece is fastened.

## Crutch Tip Closes Glue Can

PREPARED glue is usually supplied in a metal container having a friction cap, which soon becomes ineffective because of dried glue. A good plan is to discard the metal cap and replace it with an ordinary rubber crutch tip.



### TAP DRILL SIZES (Machine Screw)

[METAL WORKING]

Commercial Tap Drill	3/64"	54	53	53	50	50	47	45	45	44	43	42	40	38	37	36	34	33	31	31	1/8"	30	29	29	28	29	27	26	25	23	22	21	16	14	13	10	7	3	7/32"	2	B	D
Nominal Size	0-80	1-56	64	72	2-56	64	3-48	56	4-32	36	40	48	5-36	40	44	6-32	36	40	7-30	32	36	8-30	32	36	40	9-24	30	32	10-24	28	30	32	12-24	28	32	14-20	24	16-18	20	22	18-18	20

**Note:** The tap drills listed will produce approximately 75-percent full thread. The sizes given are National Form. National Fine (N.F.) comprises a series formerly designated as A.S.M.E. pitches and S.A.E. sizes and pitches. National Coarse (N.C.) comprises a series of former A.S.M.E. pitches and U.S. Standard sizes and pitches.

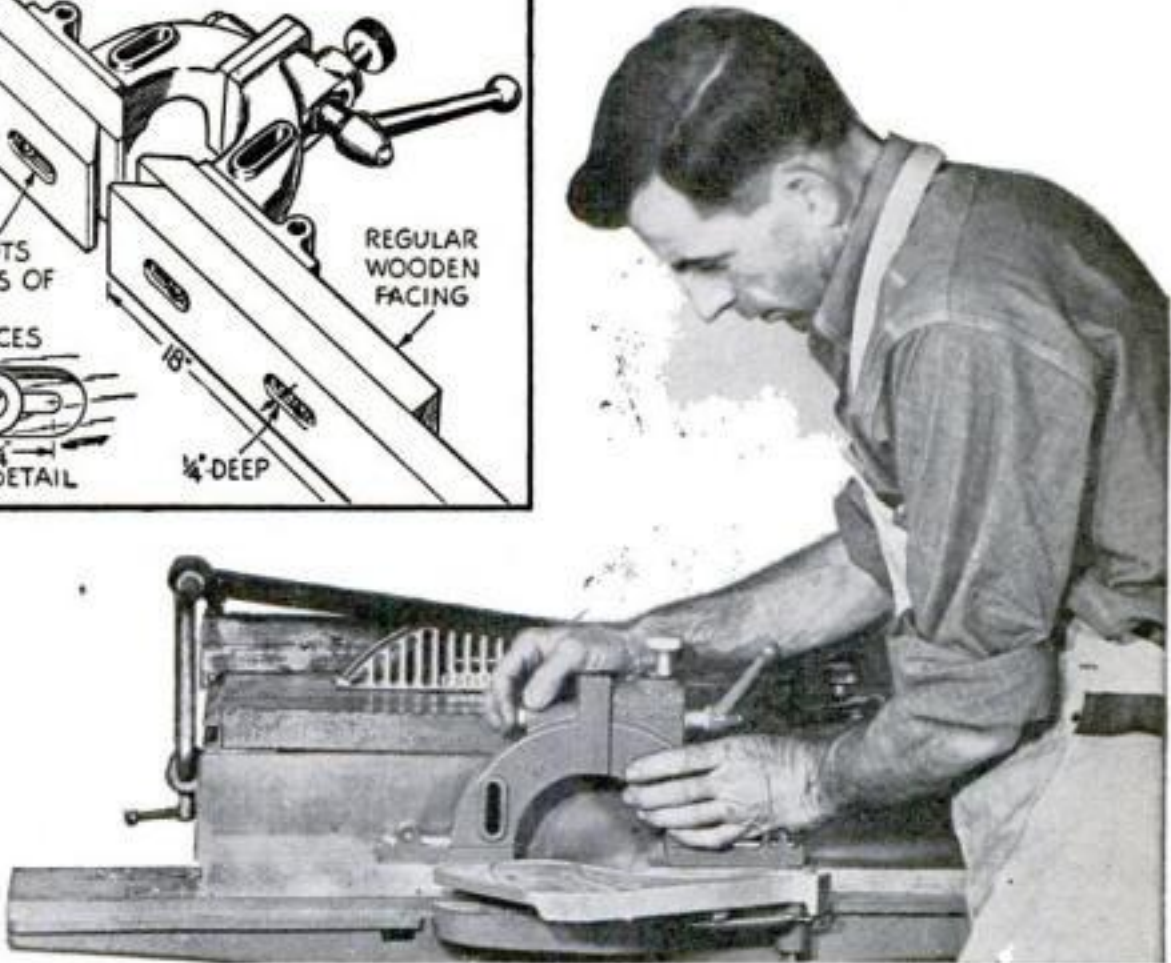
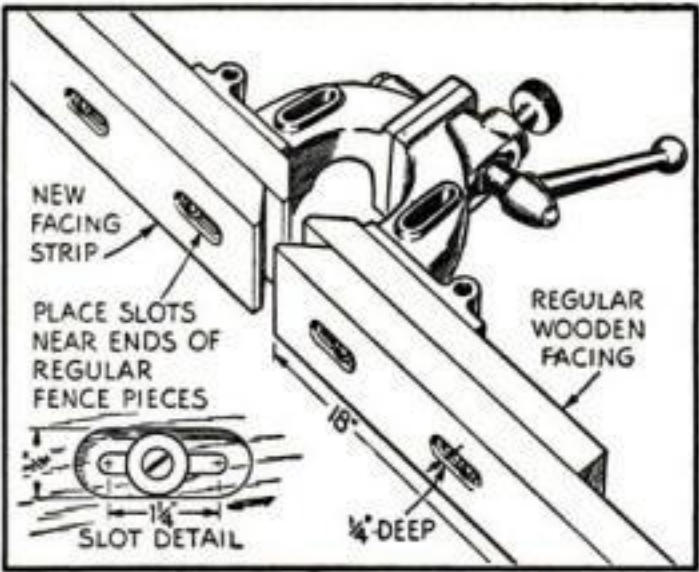
POPULAR SCIENCE MONTHLY SHOP DATA FILE



# Auxiliary Shaper Fence Gives Added Accuracy

ALTHOUGH most shaper fences are accurately made as to the metal work, the faces of the wooden strips sometimes are slightly out of parallel with one another. This can be corrected for the usual setting by aligning the faces as perfectly as possible, and then jointing them to straightness. However, since they are bolted to rather short iron seats, they may not return to parallelism if the throat opening is changed.

A better method is to bolt the regular strips permanently in place and joint as just described, and then make another set of longer wooden fences. Fit the new faces with elongated, countersunk slots, and attach with screws and washers. The original pieces then provide



accurate seats that will hold the new faces in alignment. The strips aid in guiding long lumber for grooving or molding.



## Locking Chuck Without a Key

GEARED chuck keys, especially on portable equipment, are often lost or misplaced. Since there is no safe way of locking the spindle by hand, an effective emergency measure is illustrated. Use a rod that fits the keyhole and a screw driver, or in more stubborn cases, a cold chisel.

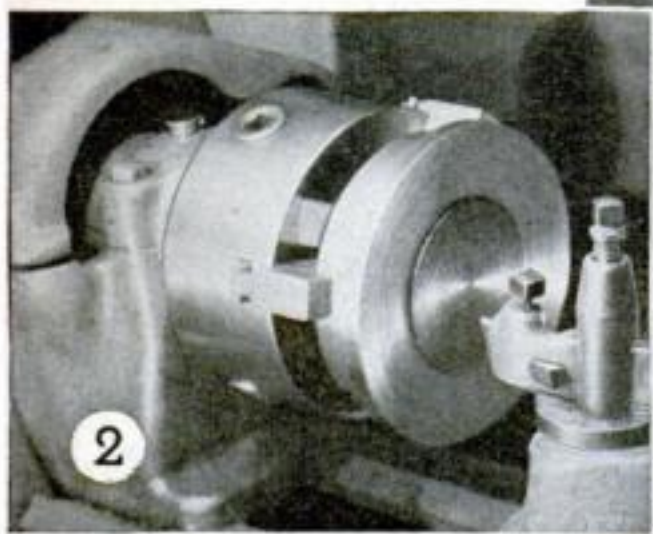
### TAP DRILL SIZES (Fractional)

[METAL WORKING]

Nominal Size	Commercial Tap Drill	Nominal Size	Commercial Tap Drill
1/16-64	3/64	5/8-12	35/64
5/64-60	3/64	18	37/64
3/32-48	1/16	27	19/32
7/64-48	52	11/16-11	19/32
1/8-32	49	12	19/32
1/4-20	49	16	5/8
3/16-24	43	3/4-10	21/32
1/2-12	3/32	12	43/64
5/8-11	38	16	11/16
15/16-10	32	27	23/32
7/32-24	1/8	13/16-10	23/32
15/64-24	30	12	23/32
1/4-20	9/64	7/8-9	49/64
5/16-18	26	12	51/64
3/8-16	22	14	13/16
7/16-14	20	18	53/64
1/2-12	16	27	27/32
5/8-11	12	15/16-9	53/64
3/4-10	10	12	55/64
7/8-9	7	1-8	7/8
15/16-10	4	12	59/64
1-8	3	14	15/16
1-10	3	27	31/32
1-12	3	1-1/8-7	63/64
1-14	3	1-1/4-7	1-3/64
1-16	3	1-1/2-6	1-7/64
1-18	3	1-3/8-6	1-11/64
1-20	3	1-1/2-6	1-7/32
1-22	3	1-5/8-5 1/2	1-19/64
1-24	3	1-3/4-5	1-11/32
1-26	3	1-7/8-5	1-27/64
1-28	3	2-4 1/2	1-29/64
1-30	3	10	1-9/16
1-32	3	2-1/8-4 1/2	1-21/32
1-34	3	8	1-11/16
1-36	3	2-1/4-4 1/2	1-25/32
1-38	3	2-3/8-4	1-29/32
1-40	3	2 1/2-4	1-29/32
1-42	3	8	1-29/32
1-44	3	2-1/2-4	2-1/32
1-46	3	2-3/4-4	2-1/8
1-48	3	3-3 1/2	2-1/8
1-50	3	8	2-1/4
1-52	3	2-3/8-4	2-3/8
1-54	3	2-1/2-4	2-1/2
1-56	3	2-3/4-4	2-5/8
1-58	3	8	2-23/32
1-60	3	2-7/8	2-7/8

POPULAR SCIENCE MONTHLY SHOP DATA FILE



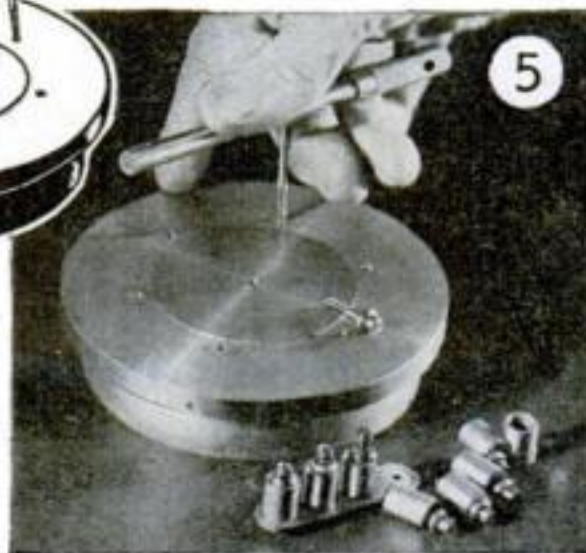
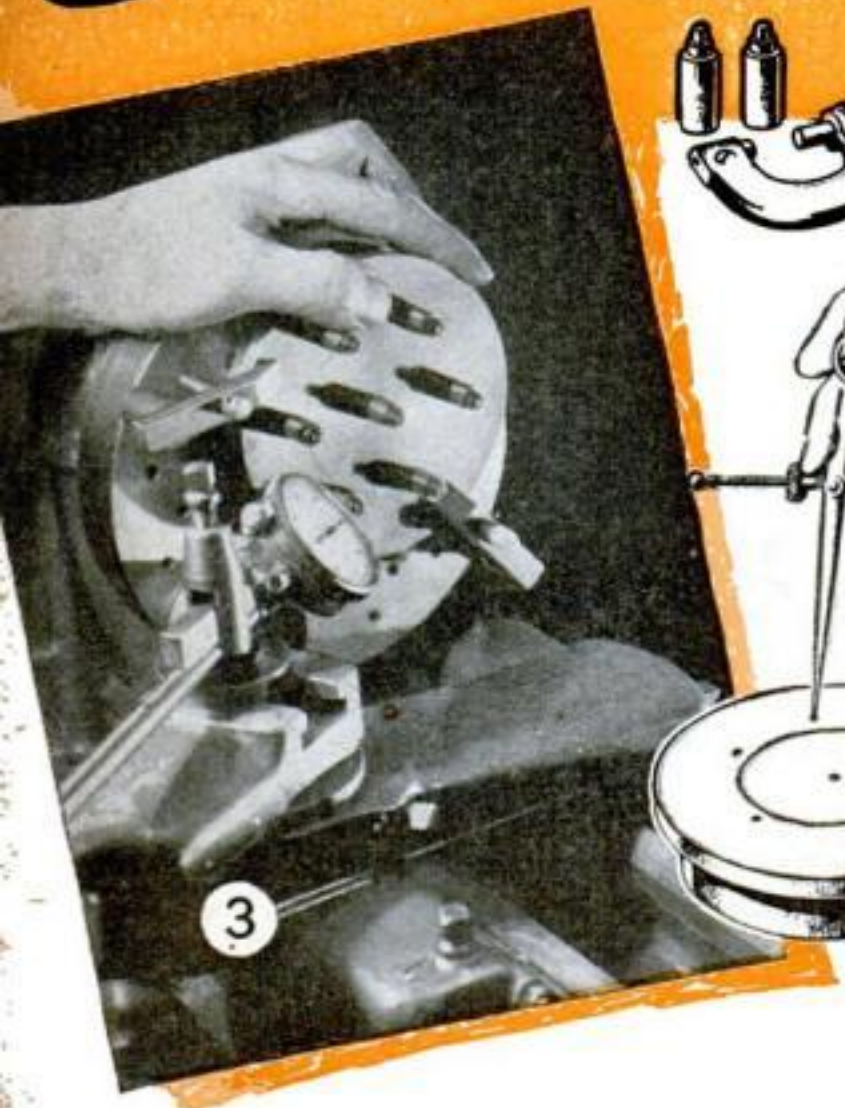


Before buttons are applied, the surface of the work must be machined or ground true

# Toolmakers' Buttons

By C. WARREN WOODSON

**F**OR absolute precision in locating holes in work that can be fastened to the faceplate of the lathe, toolmakers generally use the button method. This is a convenient way of boring accurate holes in jigs, fixtures, and die work that is not too large to be turned in the lathe. The buttons are





purchased in sets of four or more. They are small, cylindrical bushings, which are hardened, ground, and lapped square with the ends to sizes such as 0.300", 0.400", and 0.500" so as to make the figuring easy in layout work.

In use, the buttons are fastened on the work with small screws, then adjusted accurately with the vernier height gauge or micrometers, and in some cases with gauge blocks. The holes in the buttons (see the sectional drawing) are large enough to allow this adjustment. When the buttons are properly located, the screws are tightened. An indicator is used on the outer diameter of each button in turn to locate the work on the faceplate, and the work is adjusted until the button runs true. The button is then removed from the work, and the hole drilled and bored to size.

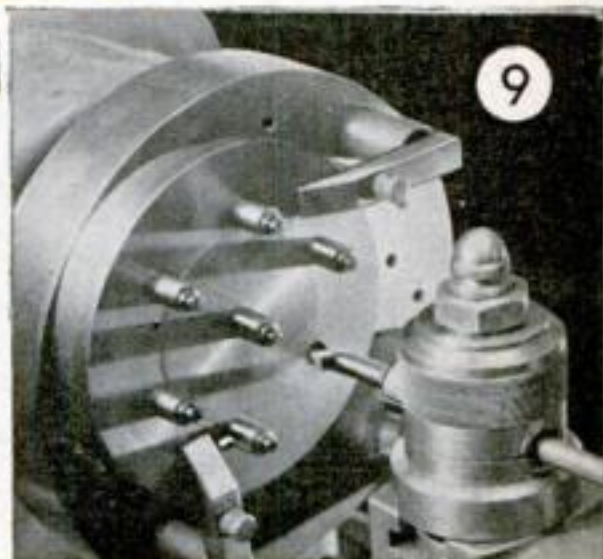
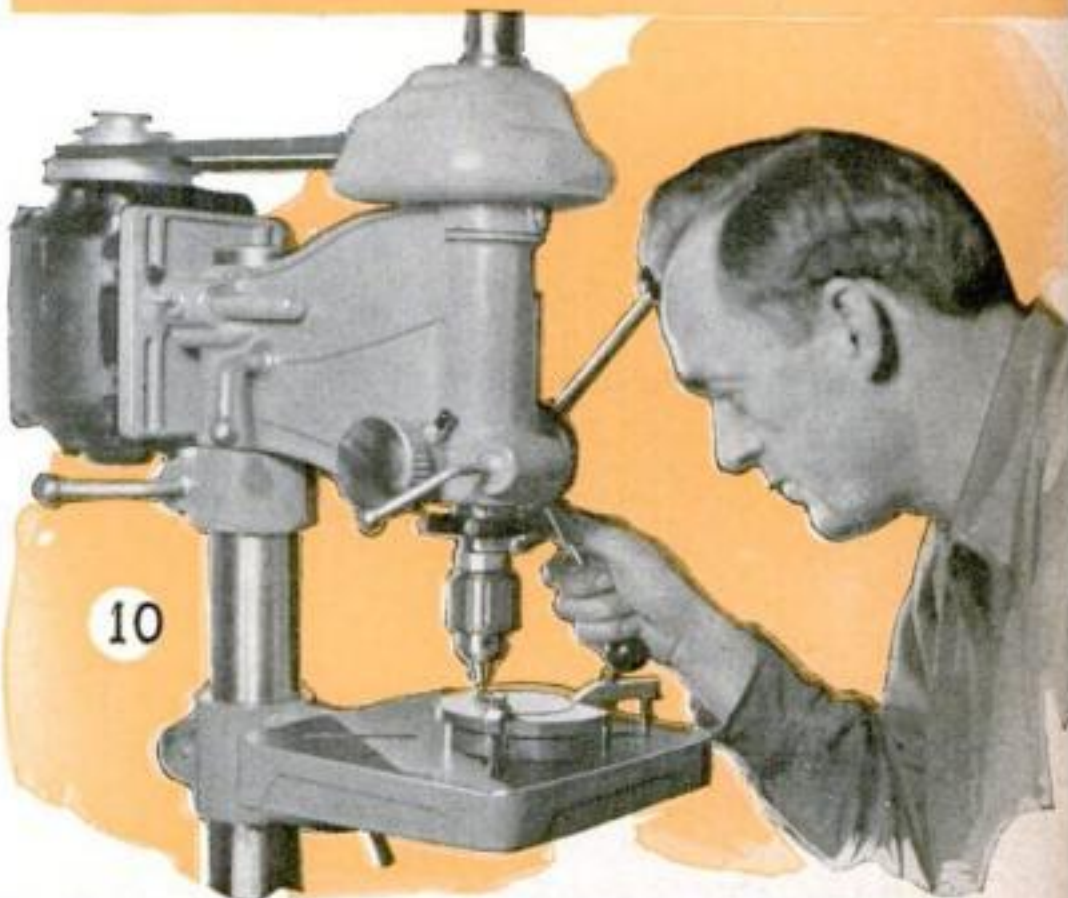
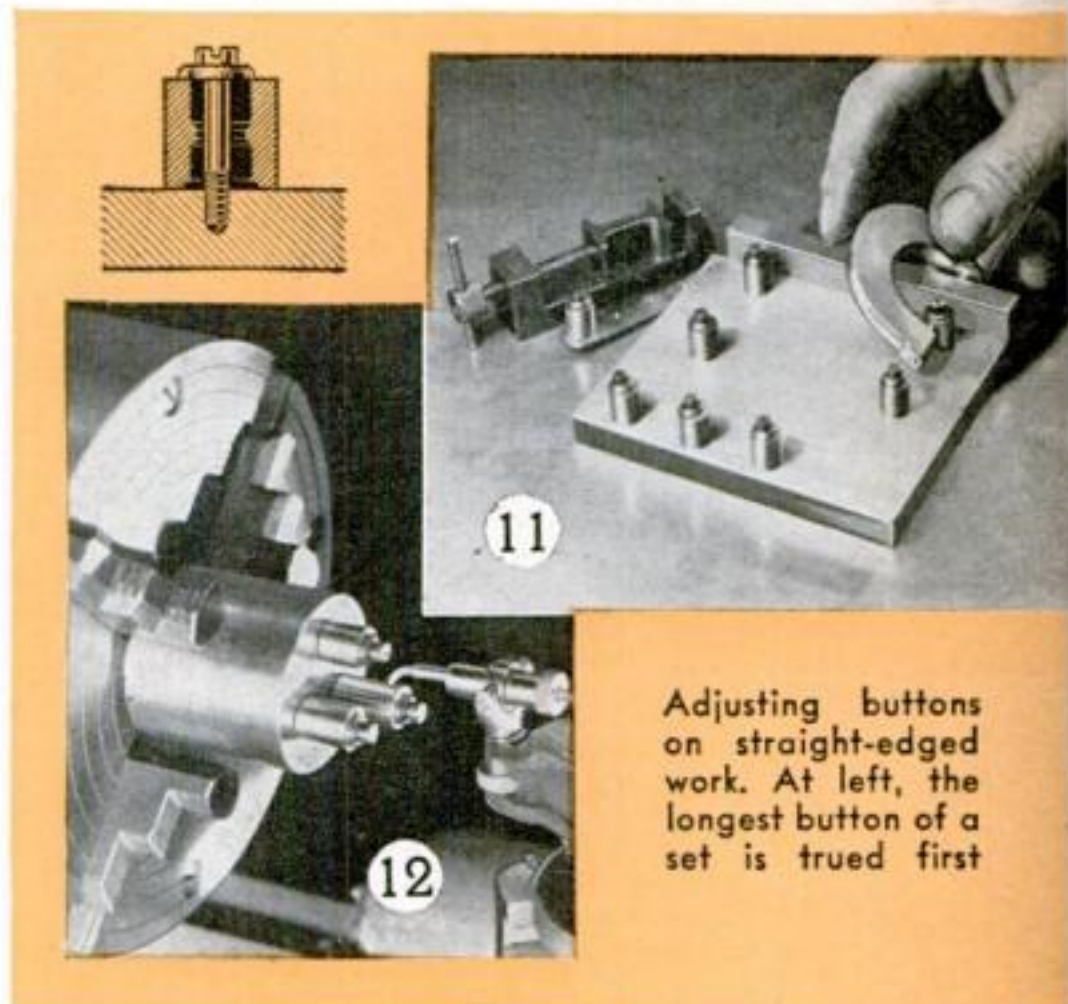
The photos show how these toolmakers' buttons were used in locating holes in part of a turret attachment for a small lathe. The disk was machined all over, Fig. 2; and in facing the top, a slight shoulder  $1/32$ " high and of the correct diameter was left for quickly locating the buttons radially. Holes were measured and stepped off with the dividers as accurately as possible, Fig. 4, then drilled for the button screws, Fig. 10, and tapped  $1/8$ "-40 as shown in Fig. 5.

Next, the buttons were screwed in place, Fig. 6, just firmly enough so that they could be adjusted by tapping them into position. When they had been accurately located with micrometers, Figs. 1 and 7, they were tightened so they would not move while being indicated true for boring. The work was strapped to the faceplate of the lathe, Fig. 8, and the off-center work well balanced with a counterweight.

In Fig. 3 the faceplate is shown mounted on the spindle of the lathe. One button was adjusted to run true with its axis by using a dial test indicator. The button was then removed and the hole drilled and bored, Fig. 9; and the operations were repeated until all the holes had been bored. If care and judgment are used in doing this, the holes will be spaced to show not over 0.0005" error between centers.

Figure 11 shows a number of buttons be-

ing located on straight-edged work. The measurements are made from a parallel laid against the side of the work. In Fig. 12, closely spaced holes are being located with buttons of three different heights. The longest button is adjusted first because this allows the indicator arm to clear the other buttons while the work is being set properly.

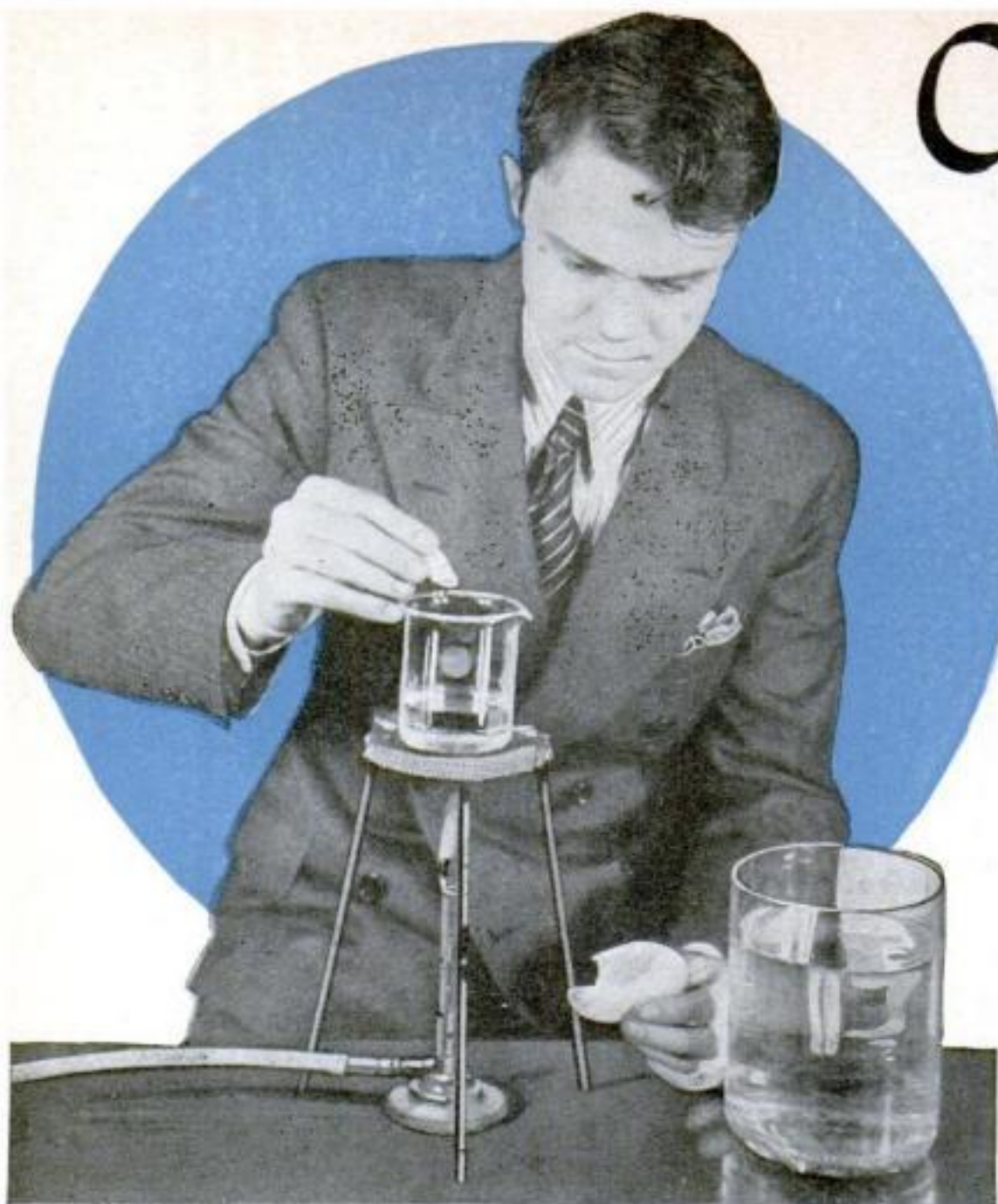




# Chemical

Ever Stop To Think How Many Experiments You Can Perform with Just a Few Chemicals? This Article Will Show You

By  
**RAYMOND B.  
WAILES**



Filter paper mysteriously dissolves in a hot calcium nitrate bath

**S**UPPOSE you had to keep on hand a bottleful of every single chemical your experiments called for. What a litter the array would make upon your laboratory shelves—and what a vacuum in your purse! But one of the most fascinating things about chemistry is the magical power that it places in your hands to change one substance into another, according to your wish. Thus you can make a few well-chosen chemicals do the work of many.

For example, the only representative of calcium in your entire stock may be some chips of marble, or a bottle of calcium chloride solution. But from either one, you can readily make all the half-dozen other compounds of calcium described in the following paragraphs, and use them in experiments that will afford entertainment and surprises.

Calcium carbonate, of which marble chips are one form, makes a good raw material for

preparing many calcium compounds. If you lack the marble, no matter. Look on your shelf for a solution of any soluble calcium compound, such as calcium chloride or calcium nitrate. Warm a dilute portion, and add a warm dilute solution of some carbonate, such as sodium carbonate (washing soda). You will promptly obtain the desired precipitate of calcium carbonate, in the white, granular form of precipitated chalk. Wash it well by decantation—that is, by pouring off most of the liquid above the settled precipitate, adding fresh water, stirring, settling, and repeating the whole process a number of times. This removes soluble impurities. Then filter out the precipitated chalk, let



These two calcium solutions properly mixed form a curious jelly that is chemically similar to marble, and which won't pour when beaker is tipped



# Stunts with Calcium

it dry at room temperature, and keep it in a stoppered bottle.

A variation of this technique produces a curious result. Instead of mixing *warm, dilute* solutions, try mixing *cold, strong* solutions of calcium chloride and sodium carbonate. They should be allowed to mingle thoroughly but gently. A good way is to place fifteen cubic centimeters (about four teaspoonfuls) of calcium chloride solution in a small beaker or a test tube, and fill a pipette with the same amount of sodium carbonate solution. Lower the tip of the pipette nearly to the bottom of the calcium chloride solution, and then raise it while slowly releasing its contents.

If your experiment has gone right, you will obtain a stiff, colorless jelly! It is so firm that it will not run out, even when you turn the beaker or test tube upside down. Appearances to the contrary, it is chemically identical with the precipitated chalk that you prepared before, for it also consists of calcium carbonate. Shake the jelly, and it turns before your eyes into the familiar white, granular form. Or set it aside, and it will spontaneously revert to ordinary calcium carbonate in the course of several hours. If you have a microscope, you may be able to see this peculiar change in structure gradually taking place.

Natural forms of calcium carbonate include eggshells and coral. Touch a bit of either of these, or of marble, to a drop of hydrochloric acid. Then hold the acidified fragment in a blue Bunsen or alcohol flame, which should become colored with the beautiful brick-red hue characteristically imparted by calcium compounds. A brilliant yellow tinge may mask the red one, however, if sodium impurities are present in considerable amount.

**H**AVING calcium carbonate, how can you convert it into other calcium compounds? Here is a good trick to remember. To make any particular chemical salt, dissolve the carbonate of that chemical in the appropriate acid. For instance, you can make calcium chloride or calcium nitrate by dissolving calcium carbonate in hydrochloric acid or nitric acid, respectively.

Suppose, first, that calcium

chloride is what you are after. You will find it a queer and interesting compound. So greedily does it absorb atmospheric moisture, in which it eventually dissolves, that it is sprinkled on roads and tennis courts to lay the dust. Lumps of it are used in chemical laboratories, and elsewhere, for drying gases and air. In solution, it serves as the refrigerating brine for artificial-ice skating rinks.

**T**O MAKE one form of calcium chloride, sprinkle powdered marble or precipitated chalk into dilute hydrochloric acid until no more bubbles of carbon dioxide gas come off. Filter the solution and allow it to crystallize. If it does not do so within a few days, hasten the process by applying heat to concentrate the solution. Stir the product with chopped ice, and the temperature of the mixture drops to more than sixty degrees F. below zero!

Another, "dehydrated" kind of calcium

Chemical magic seems to be taking place when seltzer water is added to phenolphthalein-tinted limewater. The red-colored liquid quickly fades into a colorless solution







This test shows that certain calcium compounds dissolve better in cold water than hot

chloride, may be obtained by varying the procedure slightly. Instead of allowing the filtered solution to crystallize naturally, evaporate it to dryness and continue to heat the white mass until it is dull red. Let the product cool, place it in a bottle, and stopper the bottle immediately, for this form of calcium chloride has a much stronger affinity for the moisture in the air. Dis-

solve some of the product in water, and the solution will be strongly heated, rather than chilled.

Calcium nitrate also exhibits curious properties. It, too, must be kept in a tightly stoppered bottle because of its propensity for absorbing moisture. To prepare it, place some dilute nitric acid in a beaker and add powdered marble or precipitated chalk, slowly enough to keep the effervescing mixture from frothing over. Continue adding the powder until all the acid is used up, or there is excess powder. Filter while the solution is still warm and then, if the chemical is for future use, let it crystallize. The crystals will consist of calcium nitrate.

Either the uncrystallized solution or a solution made from the crystals may be used in the following experiment. Heat the calcium nitrate solution to boiling, and add about a square inch of filter paper to it. Soon

the paper will disintegrate into extremely fine particles. If a bit of fresh nitric acid is now added, the shreds will pass entirely into solution. Strings of cotton thread, small pieces of absorbent cotton, and other cellulose materials will also dissolve in the hot, slightly acidified solution of calcium nitrate. Pour some of the resulting solution into a large [\(Continued on page 235\)](#)

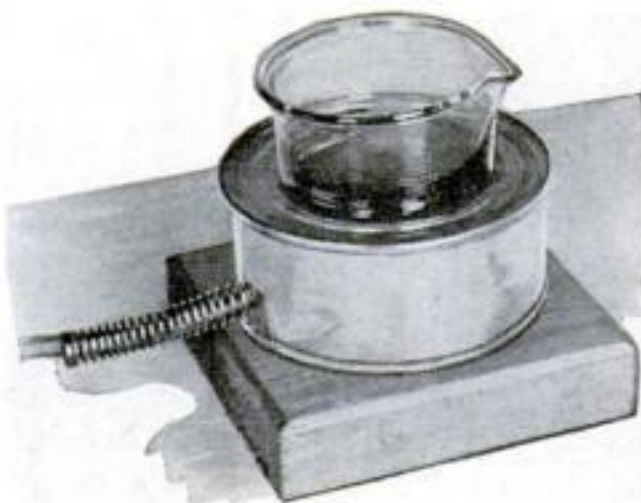
## Electric Evaporator Is Easy To Make

Two tin cans of slightly different diameter, and the element from a child's toy electric iron will make you a handy evaporator for concentrating solutions and drying precipitates. Cut down the larger can to a height of about an inch. Cut a

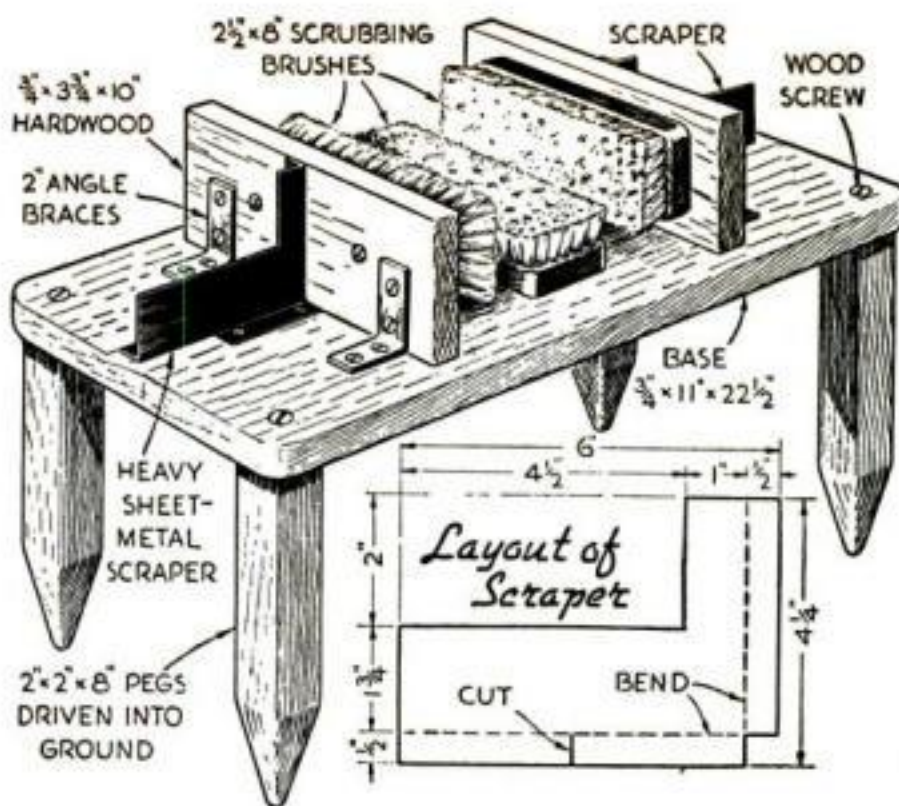
slightly wider section from the top of the smaller can, preferably a paint can that has a press-fit lid. Cut a slot in both pieces to admit the electric cord. Cover the bottom of the larger section with several layers of asbestos paper, then insert the heater and the other section. Mount the evaporator on a wooden base, and it will be ready for use.



With this homemade evaporator, you can conveniently make concentrated solutions or dry precipitates of chemicals

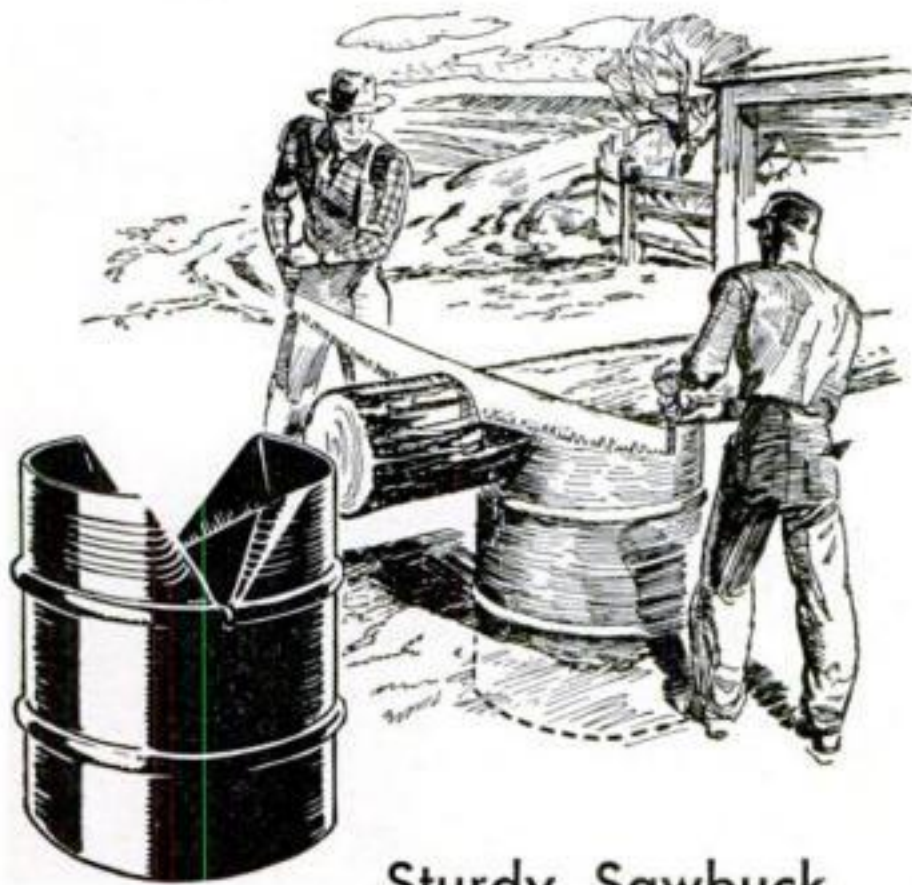






## Farmer's Shoe Cleaner

MUDDY boots and shoes are easily cleaned on the farm with the combination brush-and-scraper device illustrated. The two scrapers are L-shaped so that the soles and sides of shoes can be cleaned simultaneously. Spaces are left between the adjacent sides of the three brushes to let the dirt fall between them. Two coats of aluminum enamel will protect the wood and metal parts from the weather and also enable the cleaner to be seen in the dark. A good place for the cleaner is beside the bottom step of the rear porch.—JOHN R. HANDLEY.



## Sturdy Sawbuck Formed from Old Oil Drum

LOGS to be cut with a two-man saw can be held securely on a sawbuck made from an old 50-gal. oil drum. Split it down for about 15" on opposite sides, then turn in the edges to leave a V-shaped space. Sink the drum into the ground.—DAVID JENNINGS.

## Lawn Edger Improved with a Foot Rest

EDGING a lawn neatly along the sidewalk or other walks is always a tedious job, even if the edger is kept well sharpened. It can be made considerably easier by adding a foot rest to the edger. For this purpose a 3 1/2" by 3/8" squarehead bolt will serve very well. It is inserted through the handle about a foot from the ground. Pressure is applied to the bolt with the foot.

• • •

FOR beating out a grass fire, a length of old inner tube is effective. It lasts longer than a sack and is so heavy that the wind cannot blow it around.—E. J.



## Wide Gummed Label Acts as Blotter Handle

A SMALL piece of blotting paper can be used more expeditiously when signing a number of checks or letters if a gummed-paper label or a piece of wide gummed-paper tape is folded and stuck to the back of the blotter as shown in the sketch below to serve as a handle. Cardboard may be used to stiffen the handle.





# Bones in Sponges Revealed

**T**HERE was a time when naturalists could not make up their minds whether sponges should be called animal or plant. Now definitely classified as animals, sponges display such strange habits and methods of growth that they leave little wonder they once were suspected of being vegetable.

To the average microscopist, the part of a sponge that is of particular interest is the skeleton and the particles of which it is made. Briefly, a sponge consists of a framework on which protoplasm in the form of cells is distributed. The shape of the framework, the kinds of particles of which it is made, and the arrangement of the protoplasm vary with the sponge.

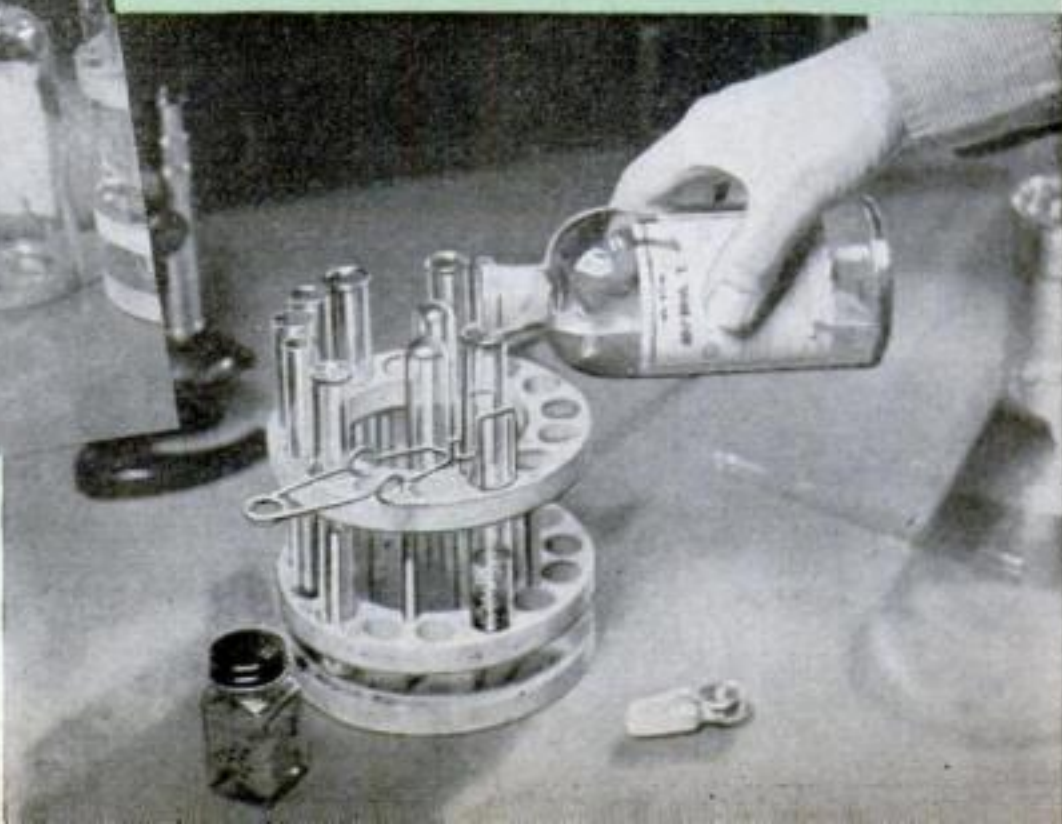
There are both salt-water and fresh-water sponges. All commercial sponges, which include those with which you take a bath, wash your car, or stipple the kitchen wall, are of marine origin. They have tough, horny skeletons consisting of fibers connected to form a more or less continuous network. Other marine sponges have skeletons composed of calcareous (lime) particles that are matted together to form a network. Fresh-water sponges have glasslike skeletons of hydrated silica. These are made up of particles that may take a variety of shapes, and usually are quite small. The most common forms are the needlelike spicules and the forms that look somewhat like the hub of a bicycle front wheel with the spokes removed.

In general, a sponge is constructed so that water, entering through numerous openings, travels through tubes or channels and emerges through other orifices. Special cells equipped with threadlike hairs or cilia line the passages, and propel the food-bearing water by waving their cilia.

Some of the fresh-water sponges survive from one season to the next, while others die off when the weather gets too cold or too hot. In order to survive from one season to the next, the sponges produce gemmules, tiny, round bodies very much like plant seeds. These gemmules, which occur on a mature sponge in a layer near its base or

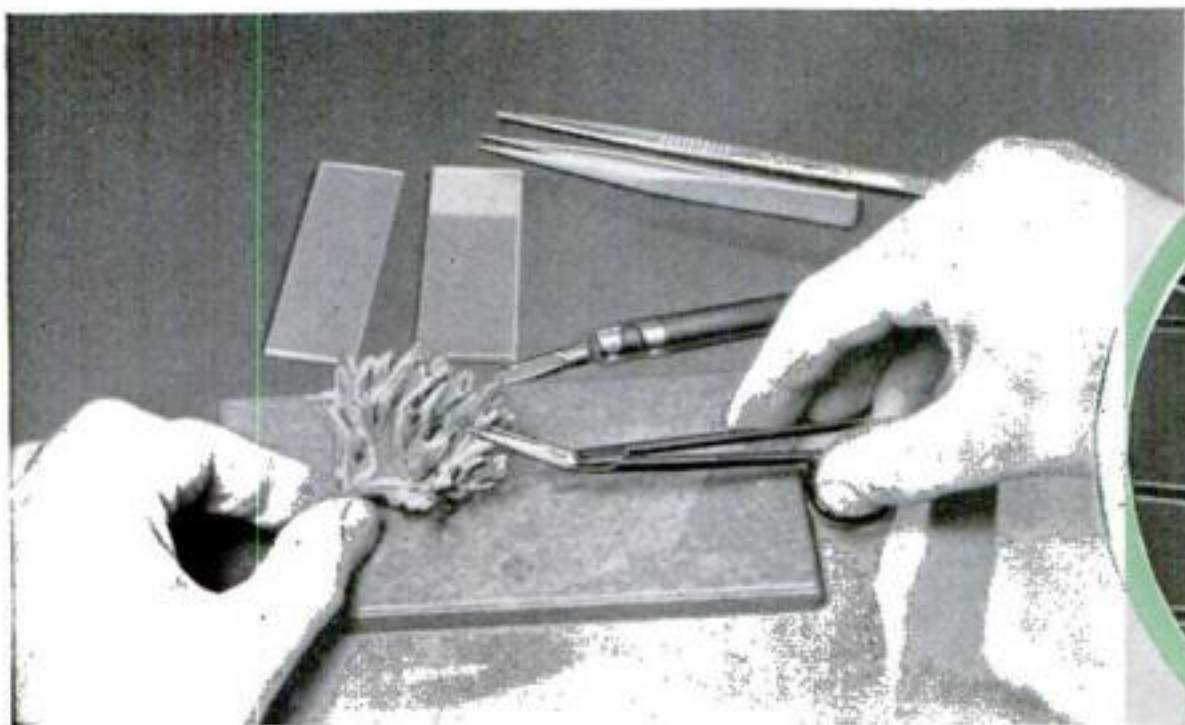
**By MORTON C. WALLING**

To heat acid or alkali solutions for separating sponge spicules, use the "double-boiler" arrangement at the left for safety. Below, adding acid slowly to a test tube containing a specimen





# by Your Microscope

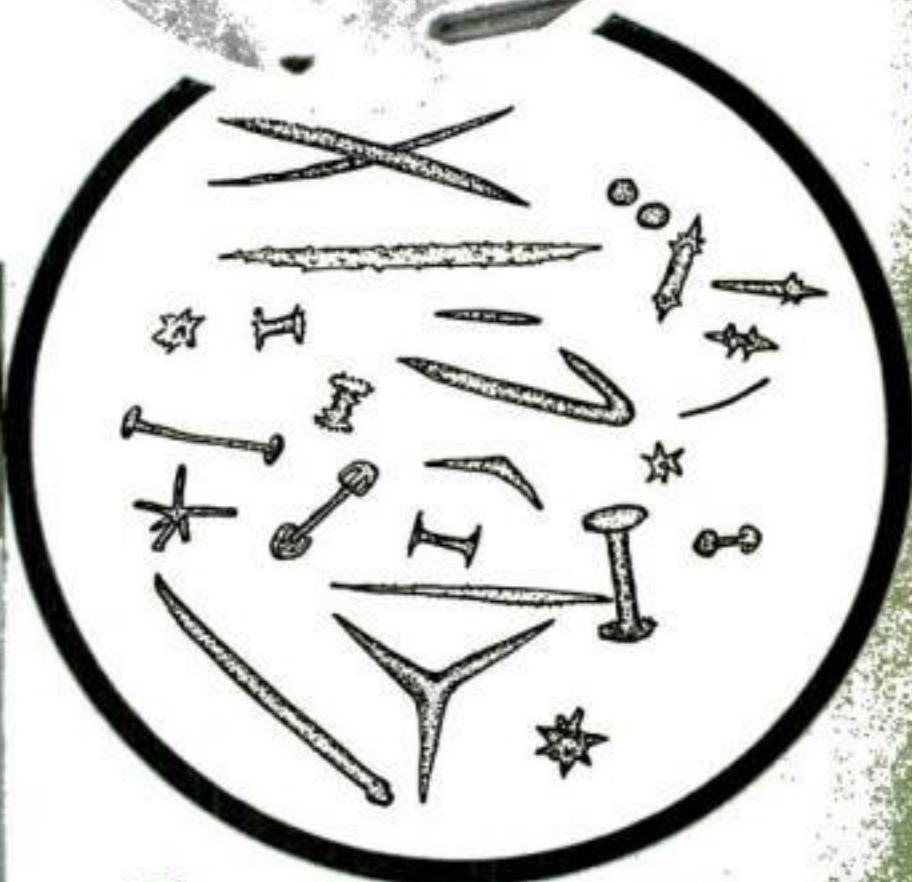
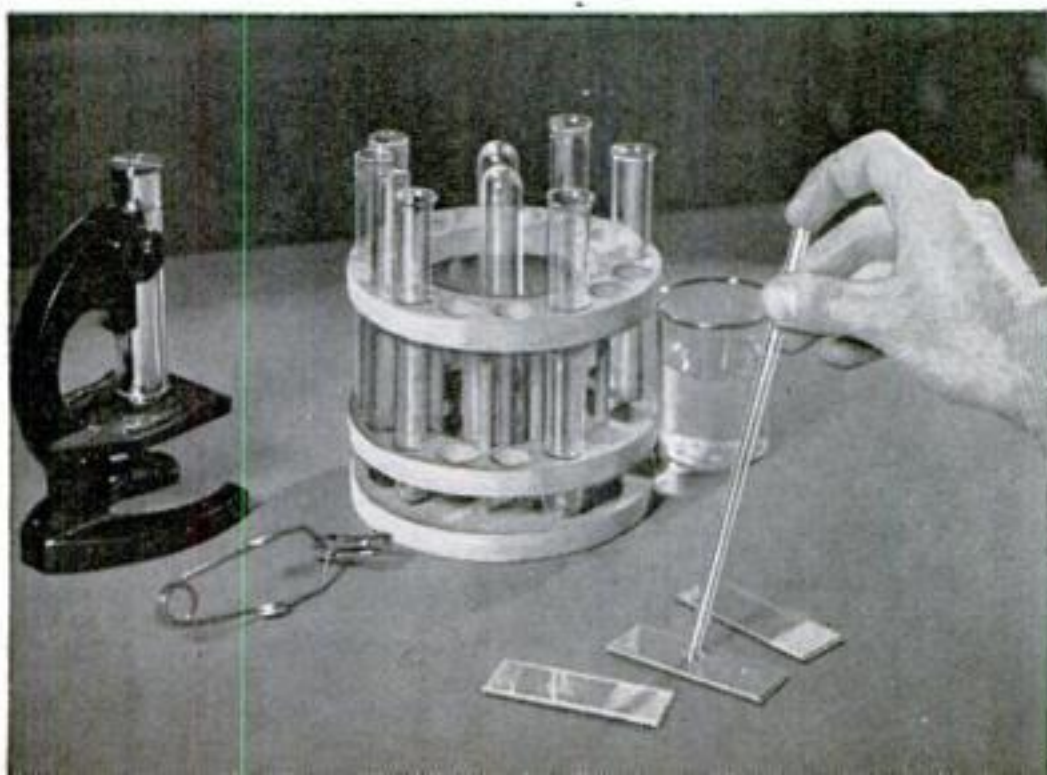
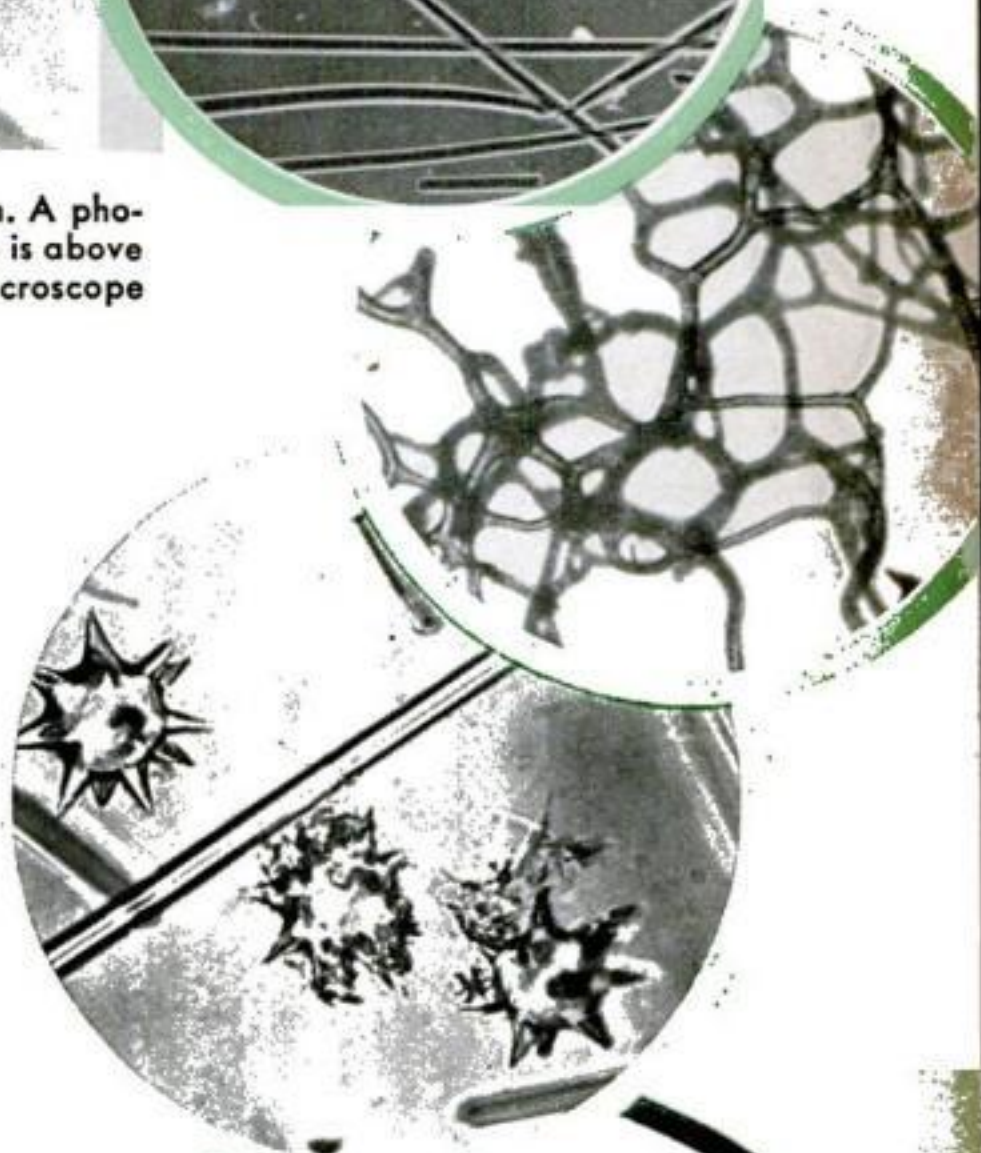
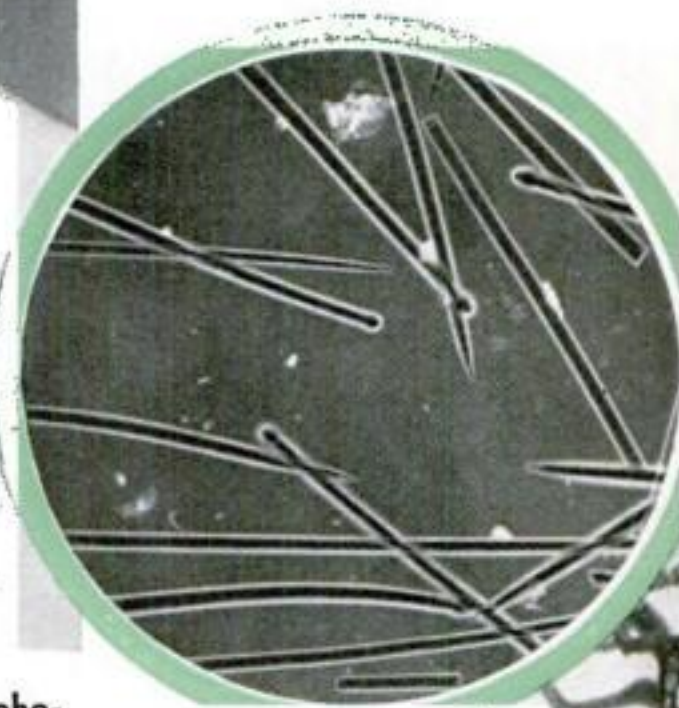


Clipping sections from marine sponge for observation. A photomicrograph showing the pinlike spicules of a sponge is above at right; below it, ordinary bath sponge under the microscope

are scattered through its tissues, consist of living cells protected by a tough, horny case that has a covering of air-filled cells and a number of spicules. These gemmules, sometimes carried by water to distant locations, begin to grow when the season becomes favorable, and produce new sponges.

The spicules and skeleton structure are the most interesting features of sponges, from the microscopist's point of view. They also are important because they are the basis for the classification of sponges. So your primary goal will be the collection of sponge spicules *(Continued on page 238)*

Spicules—pieces of sponge skeleton—shaped like slender needles and spiked balls are seen above at right. Below, using a dip tube to transfer samples to microscope slides preparatory to examination



*Typical Sponge Spicules*



# SCIENCE IN

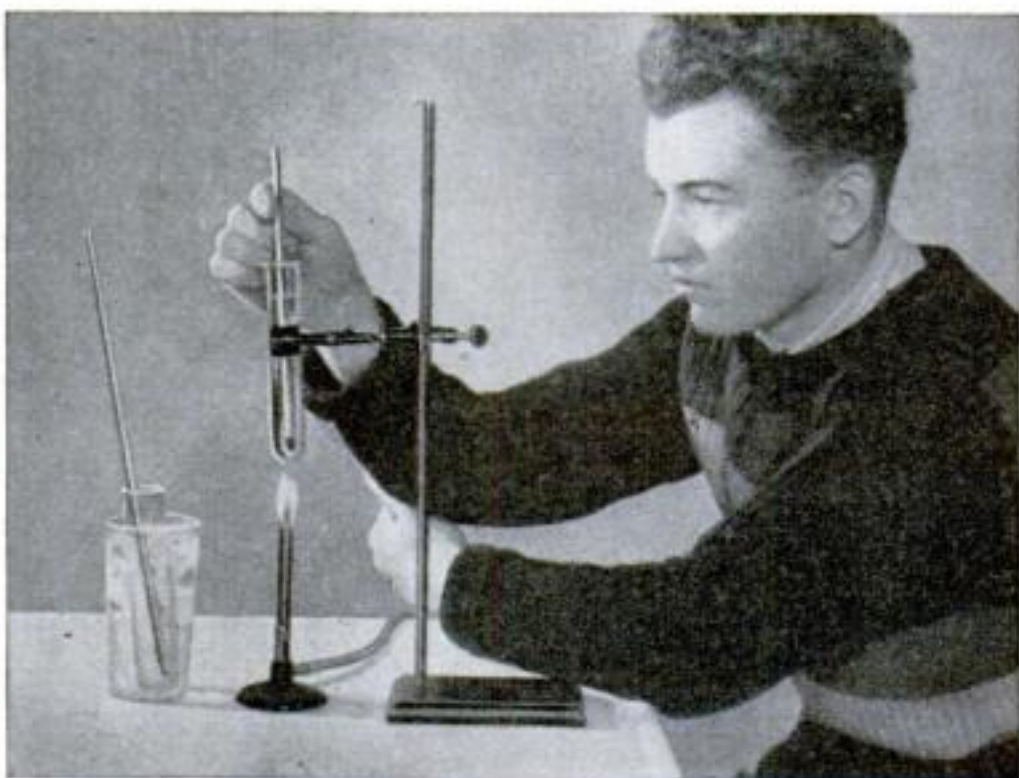
## Electric Charge Shown To Be Only Skin Deep

SHAPE metal foil around a brass globe from a bedpost, and then cut the foil to form two hemispheres. Attach a handle of insulating material to each, with wax, and stand the globe upon an inverted glass tumbler. Now cover the globe tightly with the cups of foil. Have some one charge the metal with an electrophorus (P.S.M., Nov. '39, p. 211). Remove the pieces of foil simultaneously, and you will find them charged, but there will be no electric charge on the globe. The charge always resides on the surface of a conductor.



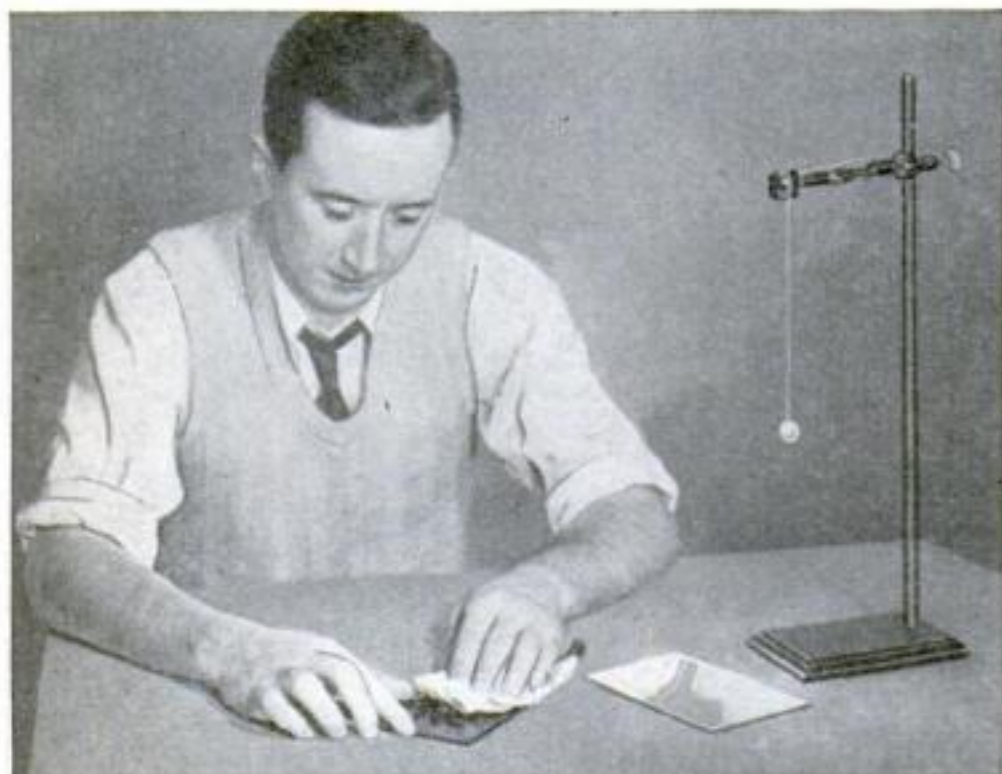
## Ice Melts, Water Freezes, at Same Temperature

ICE MELTS, and water freezes, at the same temperature. To prove this apparent paradox, heat a test tube of crushed ice or snow. A thermometer will show the temperature constant at thirty-two degrees F. during the melting. Now place a test tube of water in salt and ice, and stir with a thermometer. This time the temperature stays at thirty-two degrees while the water freezes. Whether melting or freezing occurs depends upon whether calories of heat are being added or taken away. This produces no temperature change until the difference in heat content between water and ice, at thirty-two degrees, has been offset.



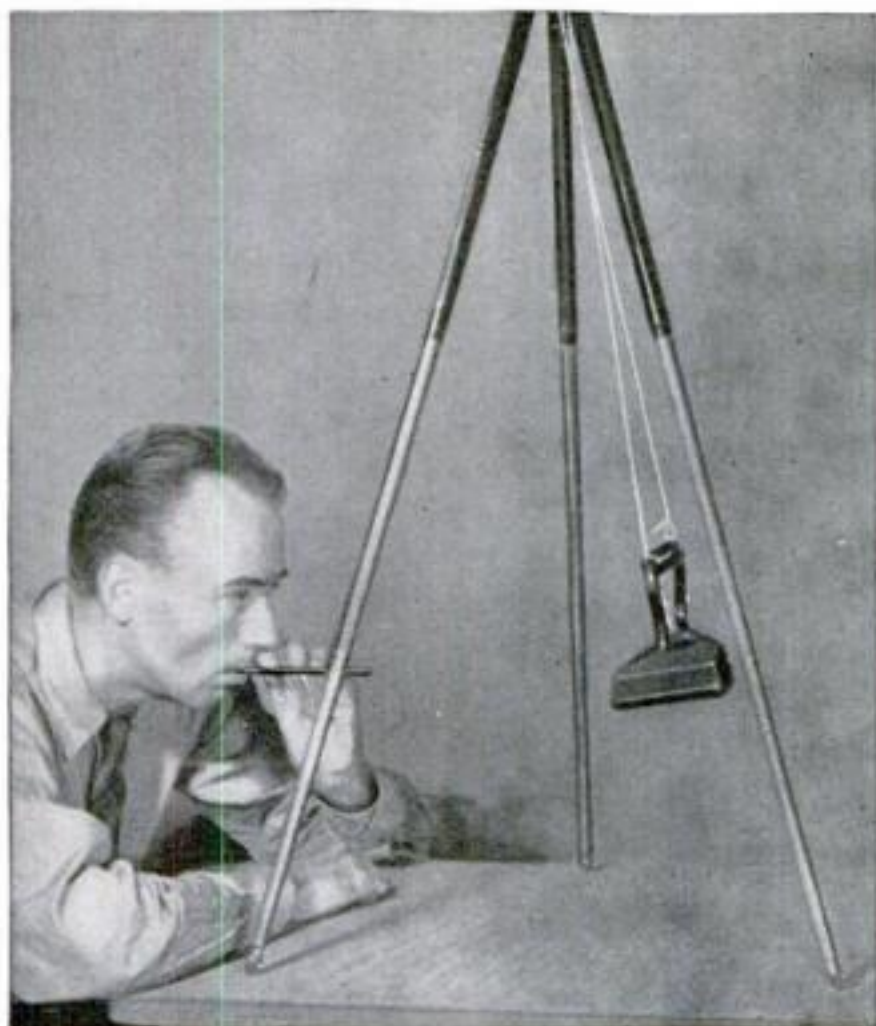
## The Charge Depends on Substance Rubbed

RUB a sheet of hard rubber briskly with a piece of silk. Touch the hard rubber, which is now positively charged, to a pith ball hanging on a silk thread until the pith ball is repelled. Now rub a sheet of glass with silk. The glass will attract the pith ball, showing that silk gives glass a negative charge. In each case, the silk itself acquires a charge of opposite sign to the one it imparts. Thus different charges may be produced upon material, depending on what is rubbed with it.





# EASY HOME TESTS



## Test Shows Effect of Rhythm in Vibration

ALL bodies capable of vibration have a certain definite frequency, or "pulse rate," at which a comparatively small force applied repeatedly will set them oscillating strongly. Thus a pendulum improvised from a heavy iron and cord may be set swinging through a wide arc, merely by light puffs of breath at the right intervals. Starting the iron swinging by hand will reveal the right rhythm. Puffs at any other rate, or irregularly timed ones, will have little or no effect.

## Gases Easily Compressed, But Liquids Are Not

HALF-FILL a glass flask or bottle with water. Pass a glass tube through a tightly fitting stopper, so that the lower end of the tube dips under water. Because of the compressibility of the air in the vessel, you can blow air bubbles through the water, and the air pressure will send water back up the tube when you remove your lips. If you repeat the experiment with the vessel full of water, bubbles will not enter it, no matter how hard you may blow, for the water is practically incompressible.

Air blown into a half-filled flask backs the water up into the tube



## Tire Valve Proves Air Is Cooled by Expansion

IF THE plunger in the air valve of an automobile tire is pushed down by the bulb of a thermometer, as in the illustration at right, air will rush out around the bulb. Immediately the temperature indicated by the thermometer will go down, showing that the previously compressed air is cooled as it expands. The principle of cooling by the expansion of gases is used widely in mechanical refrigeration, and in the production of "dry ice." The cooling of air by expansion, as it ascends, is a common cause of the condensation of water vapor into clouds or rain, and thus must be taken into consideration in forecasting changes in the weather.





# New Radio Aids for



## Unit Connects Any Instrument to Any Radio

WITH a contact-type microphone and a small "booster" transformer now available, the music of a guitar, piano, violin, or any of a number of other instruments, may be "electronically" amplified through your own radio and speaker. A switch on the transformer housing permits either the radio or the pick-up to be turned on at will. The device may be used even with battery-type portables, enabling one to carry a guitar or similar instrument on trips and to have an amplifier and speaker always on hand. For maximum amplification, a set with at least two stages of audio amplification is recommended. In the photograph at the left, the pick-up is being used with a guitar.

How guitar music may be amplified through your radio with the pick-up

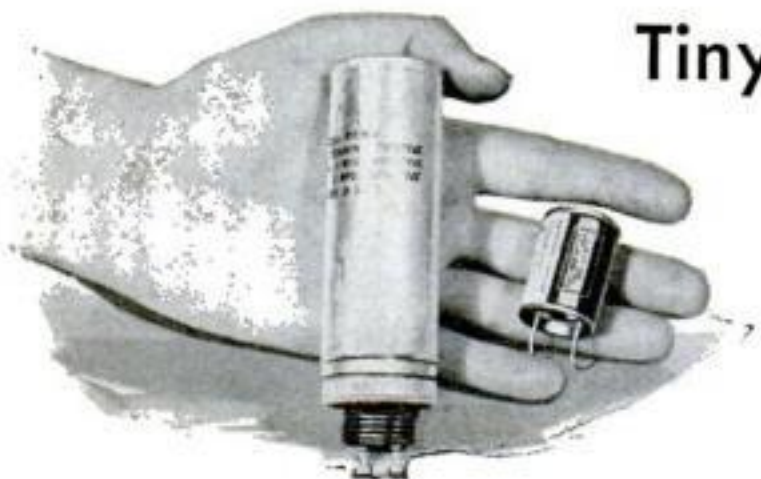
## Experimental Electric Eye Is Designed for Amateurs

A PRACTICAL photo-electric cell just marketed generates its own electricity according to the amount of light it receives. Complete instructions tell how to set up the light-sensitive cell and conduct experiments, such as transmitting the voice over a light beam, setting up a burglar alarm, and controlling model-railroad trains. The kit includes a lead anode, chemically treated cathode, two binding posts, a glass jar and cap, and a gelatin capsule of the necessary soluble chemicals.



## Tiny Dual-Electrolytic Condenser

ONLY an inch and an eighth long, a tiny new dual electrolytic condenser nevertheless is rated at 250 volts, and is available in capacities of four-and-four or eight-and-eight microfarads. It has a common-ground connection, and is adequately protected from short circuits with other parts of a set by a heavy cardboard jacket. It is seven eighths of an inch in diameter.





# Amateur Set Builders



## Light Simplifies Radio Work

AMATEURS as well as professionals will find the handy new tool shown in use at the left of great convenience for seeing into the heart of a set to make adjustments or solder connections in hard-to-get-at places. Made of "lucite," a transparent plastic which light follows like water passing through a hose, the device contains a flashlight bulb and cells in its handle. It is a nonconductor, so there is no danger of short circuits as the business end of the light probes the depths of a radio chassis.

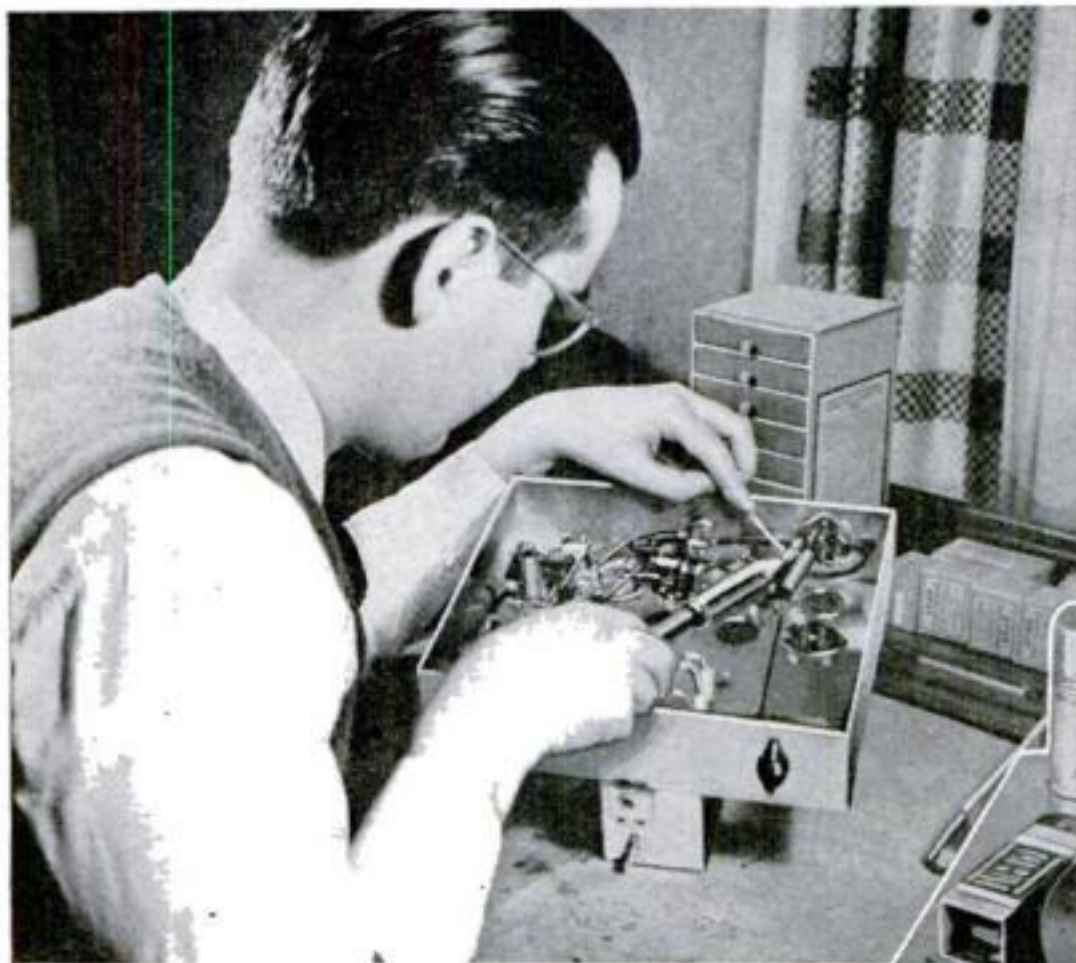
## Speed Controls Car Receiver

AUTOMOBILE radios designed for one make of car now come equipped with a novel circuit which automatically raises the receiver's volume to offset the increased noises as the car's speed is increased. An ingenious air switch connected to the "levelizer" circuit does the trick.

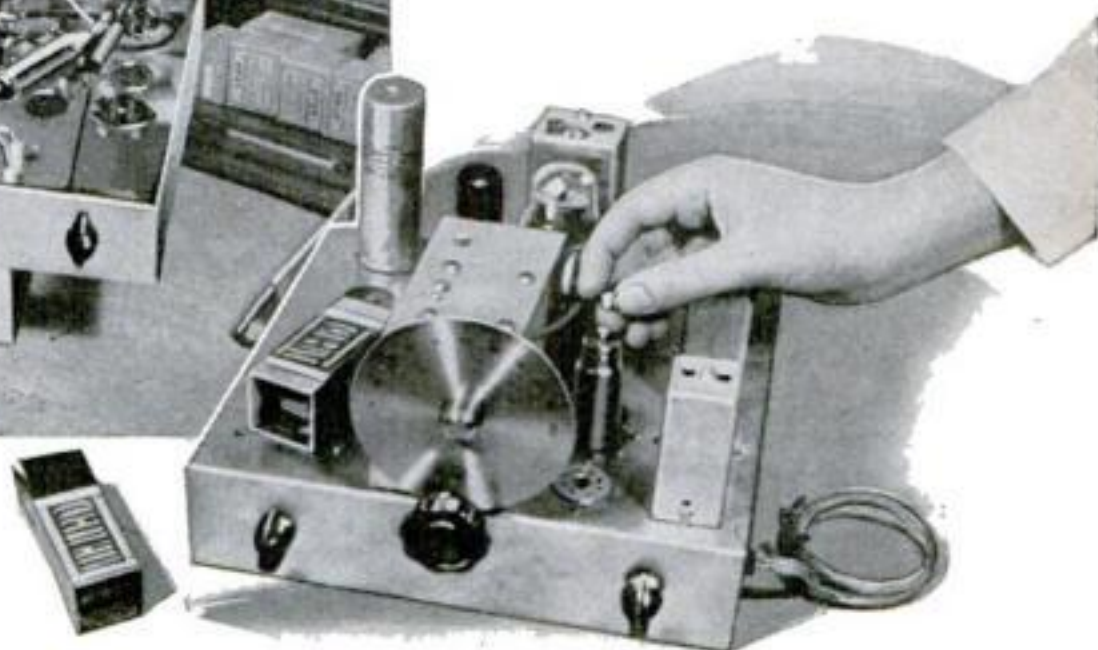
## Changeover Kit for Staticless Radio

INTEREST in "frequency-modulation" radio broadcasting and receiving, which virtually eliminates static and "man-made" interference from reception, has led one manufactur-

er to place a compact frequency-modulation adapter kit on the market. It is designed to feed its "staticless" signals directly into the amplifying circuit of your present radio, making the purchase of an entirely new set unnecessary. At least one frequency-modulation transmitter (P. S. M., July, '35, p. 16) is now in operation, carrying the programs of a national radio network. In the expectation that others soon will be operating, the kit has been placed on sale. It includes all necessary parts, along with diagrams, and full instructions for assembling.



Putting the finishing touches on the chassis of the frequency-modulation converter. It can be attached to any receiver. Right, top view





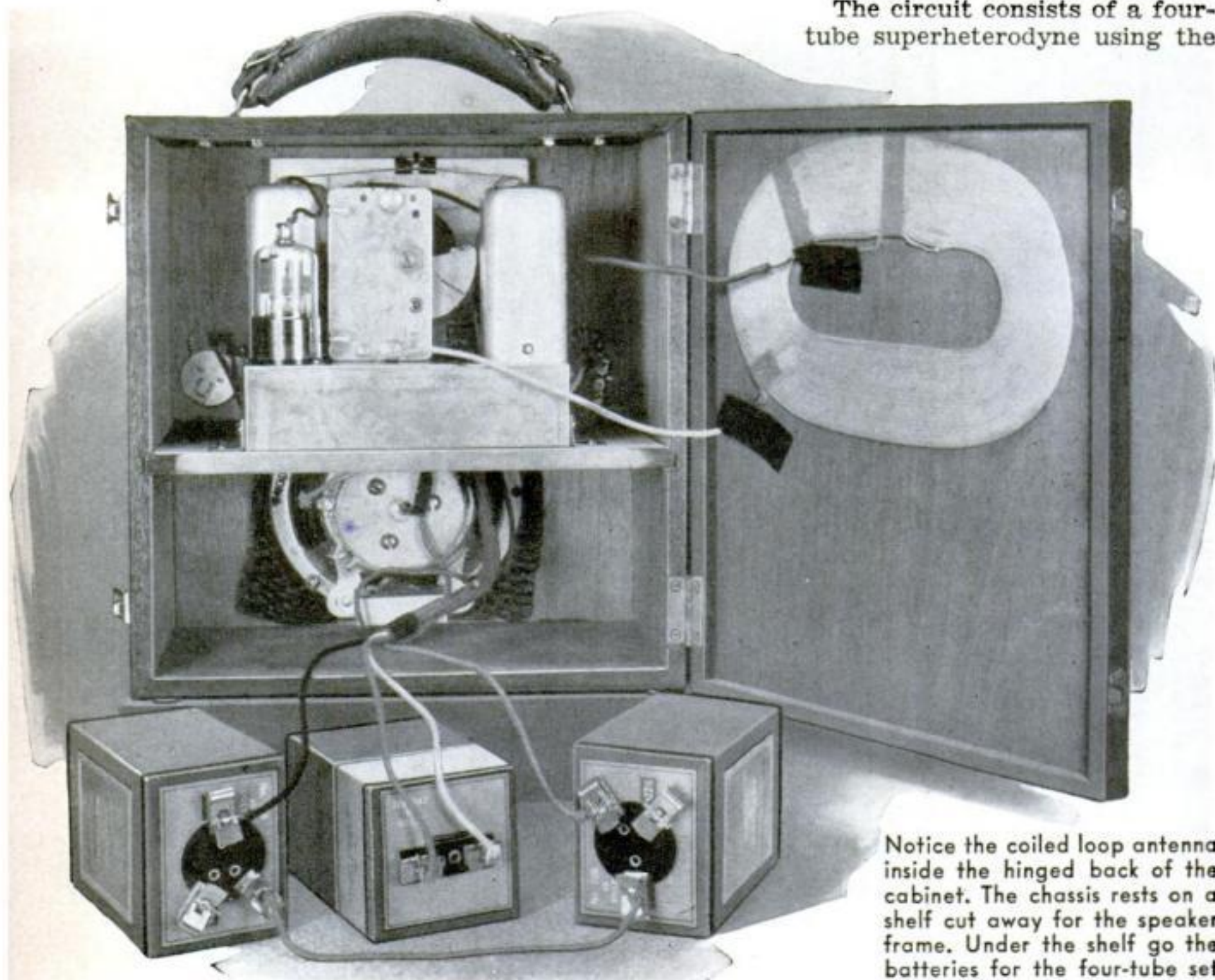


# All-Purpose

By ARTHUR E. MILLER

**E**XTREMELY compact and light, this battery portable will work anywhere—on trains, in the home, on a boat, in the city or country. Having a loop inside the case, the set needs neither antenna nor ground connections. It has a nighttime range of 500 miles and a daytime range of more than 100 miles. If greater distances are required, an antenna may be attached to the loop by an extra connection provided for this purpose. It consists of two extra turns which are loosely coupled to the other turns on the loop. One side of this extra "coil" is grounded to the chassis—the antenna being attached to the other side.

The circuit consists of a four-tube superheterodyne using the



Notice the coiled loop antenna inside the hinged back of the cabinet. The chassis rests on a shelf cut away for the speaker frame. Under the shelf go the batteries for the four-tube set



# Portable

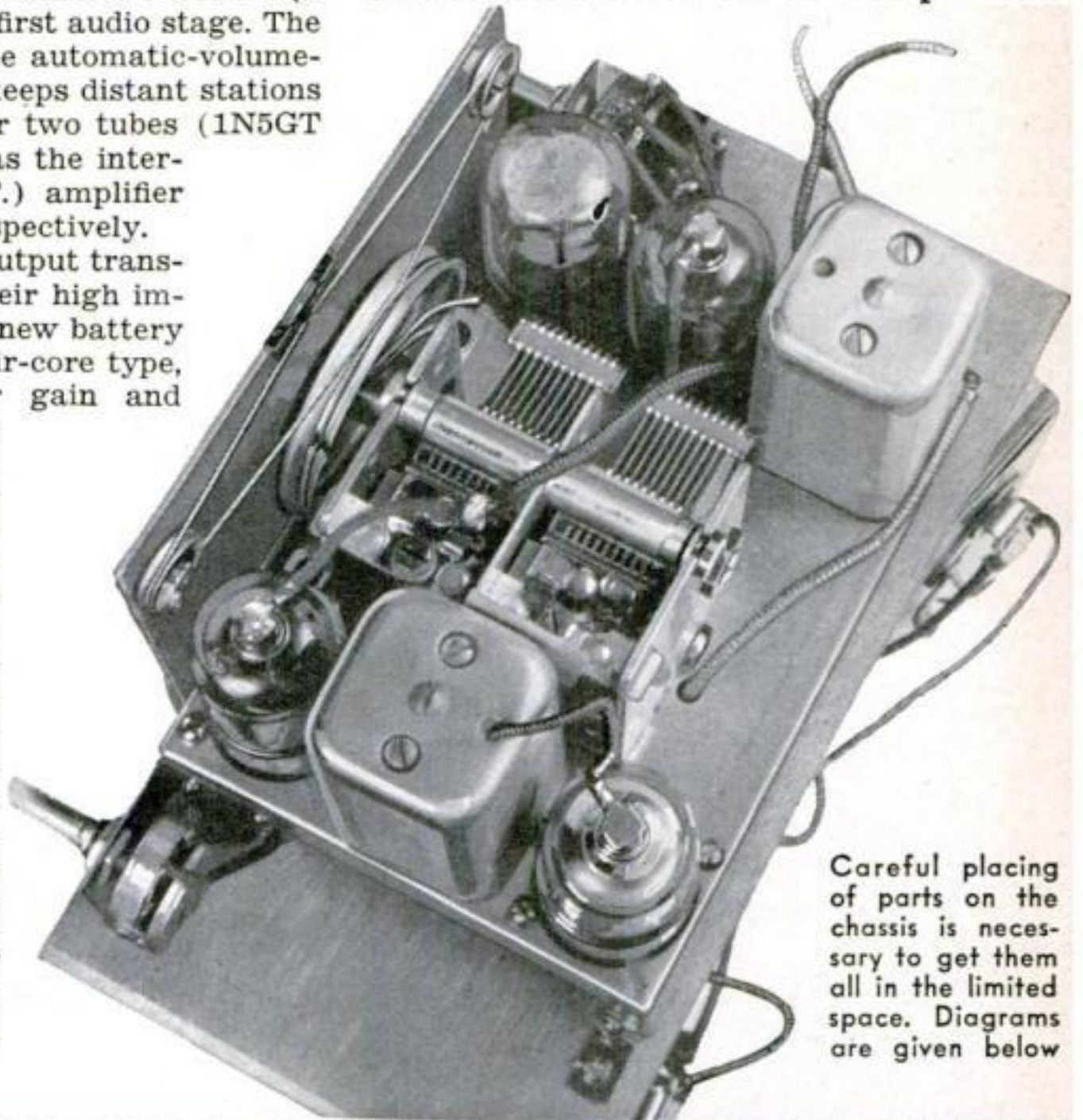
## EASILY BUILT RECEIVER FOR USE AT HOME OR ON YOUR VACATION

new small-size 1.4-volt tubes. The first tube, the 1A7GT, acts as a combined first detector and oscillator, while the third tube, the 1H5GT, fills the rôle of second detector (a diode in this case) and first audio stage. The 1H5GT also controls the automatic-volume-control current which keeps distant stations from fading. The other two tubes (1N5GT and 1C5GT) are used as the intermediate-frequency (I.F.) amplifier and power pentode, respectively.

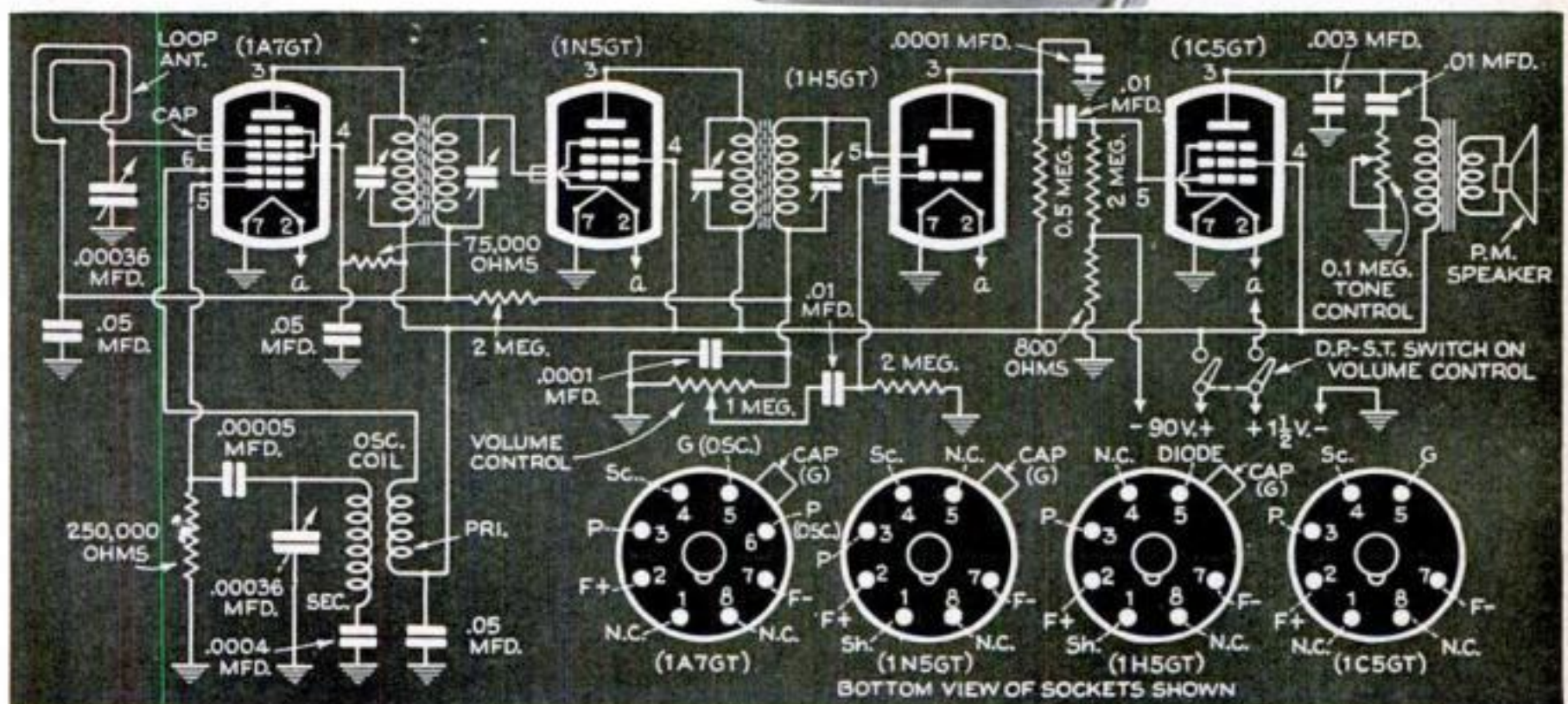
Iron-core input and output transformers are used, as their high impedance matches these new battery tubes better than the air-core type, resulting in a higher gain and greater selectivity. On top of each of the I.F. transformer cans are two screws which are connected to the rotors of the primary and secondary trimmer condensers. These must be adjusted carefully with a small insulated screw driver while the set is in operation in order to tune the I.F. transformers to their resonance peak of 455 kilocycles.

Care must be taken in punching out the  $1\frac{1}{2}$ " by  $4\frac{3}{8}$ " by  $5\frac{3}{4}$ " chassis. If desired, of course, it

may be purchased already punched, ready for the parts to be mounted on it. The volume control, with its on-off switch, and the tone control are mounted on L-shape metal



Careful placing of parts on the chassis is necessary to get them all in the limited space. Diagrams are given below







brackets attached to either side of the chassis in front. A piece should also be cut out in front of the chassis to clear the speaker frame, which otherwise is too large to fit in the bottom compartment. The speaker frame must be grounded to the chassis.

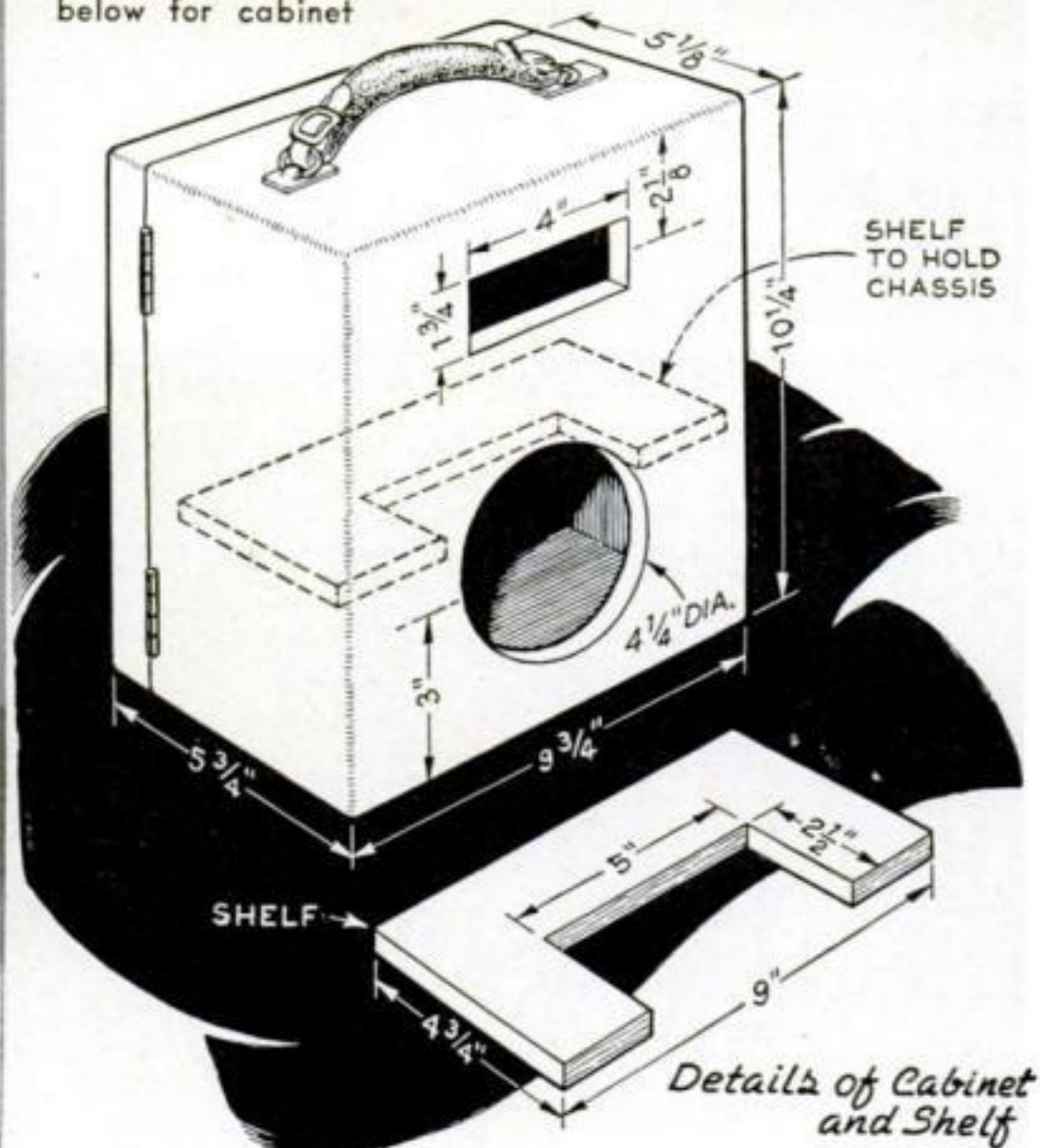
Mahogany,  $\frac{3}{8}$ " thick, was used to make the cabinet. A shelf is placed inside the case to support the small steel chassis, which is held in place by two  $\frac{1}{2}$ " right-angle brackets.

The tiny loop antenna ( $\frac{1}{16}$ " by 5" by 8"), which can be purchased ready-made, comes with a paper backing so that it may be easily glued in place on any surface. The best place for it is on the inside of the back cover. Any ordinary glue may be used, but not paste. The back cover which is only  $\frac{5}{8}$ " thick is hinged to the front portion by two  $1\frac{1}{4}$ " brass hinges and is fastened by two small brass latches.

## LIST OF PARTS

P-M speaker, 5".  
 Tuning condenser, 2 gang, .00036 mfd.  
 Oscillator coil.  
 Iron-core I.F. transformers, 455 kc.  
 Volume control with D.P.S.T. switch, 1 meg.  
 Tone control, 100,000 ohm.  
 Tubes: 1A7GT, IN5GT, IH5GT, 1C5GT.  
 Portable 45-volt "B" batteries (two).  
 Portable 1.5-volt "A" battery  
 Carbon resistors:  
    $\frac{1}{2}$  watt, 2 meg. (three).  
    $\frac{1}{2}$  watt, 500,000 ohm.  
    $\frac{1}{2}$  watt, 250,000 ohm.  
    $\frac{1}{2}$  watt, 75,000 ohm.  
    $\frac{1}{2}$  watt, 800 ohm.  
 Tubular condensers:  
   .05 mfd. (three).  
   .01 mfd. (three).  
   .003 mfd.  
 Mica condensers:  
   .0001 mfd.  
   .0004 mfd. (padding).  
   .00005 mfd.  
 Electrolytic condenser, 8 mfd., 150 volts.  
 Miscellaneous: Chassis, cabinet, 4 octal wafer sockets, dial, wire, battery cable, loop antenna, etc.

This good-looking portable is light. Follow the sketch below for cabinet

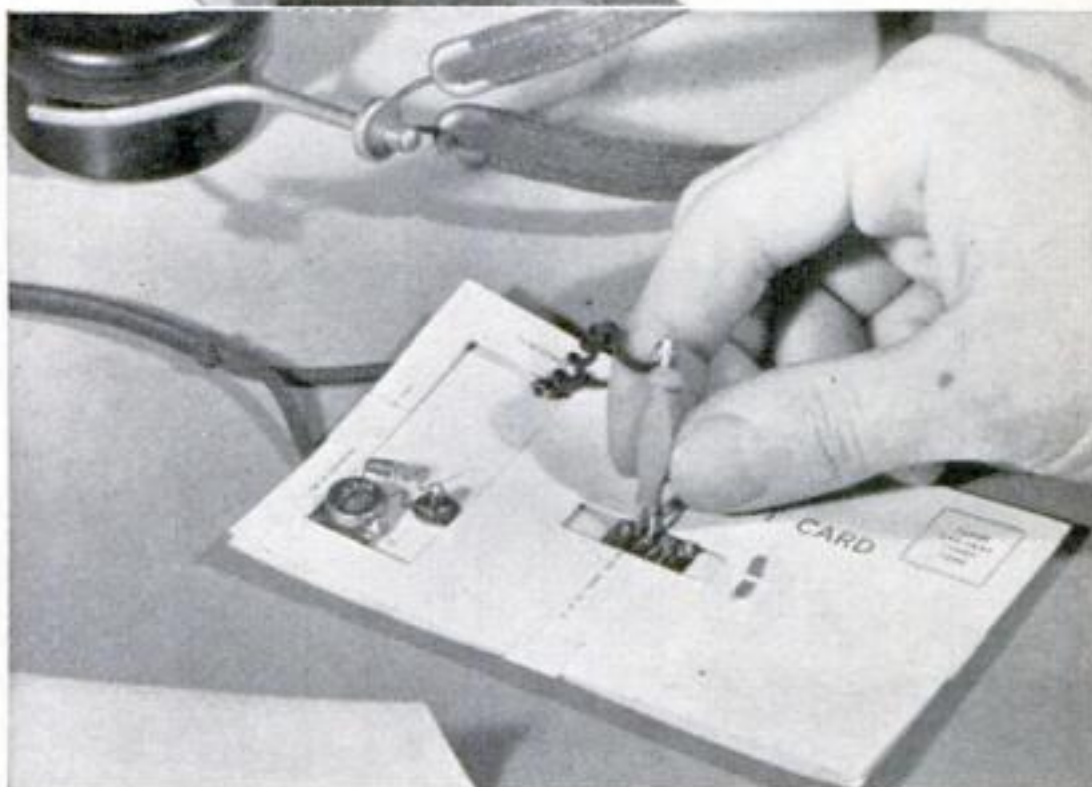
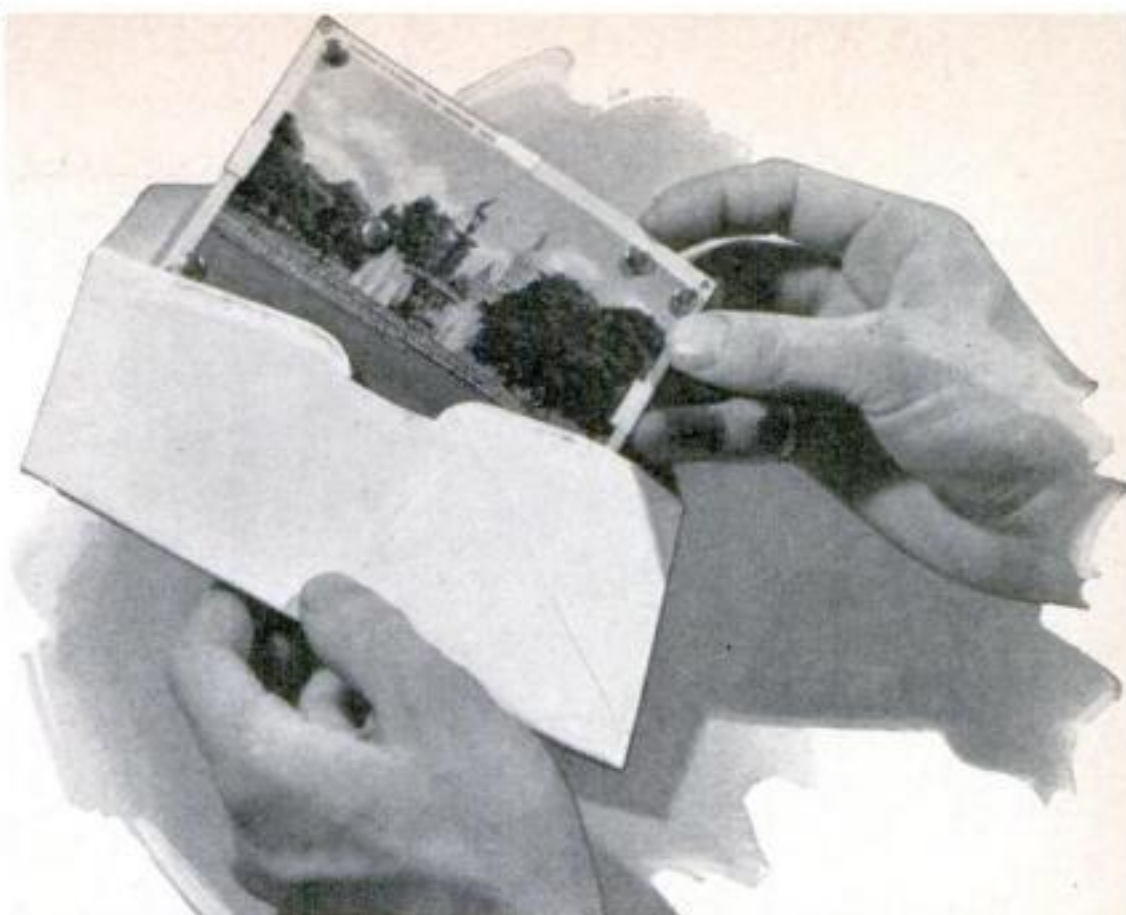




# "LETTER" RADIO

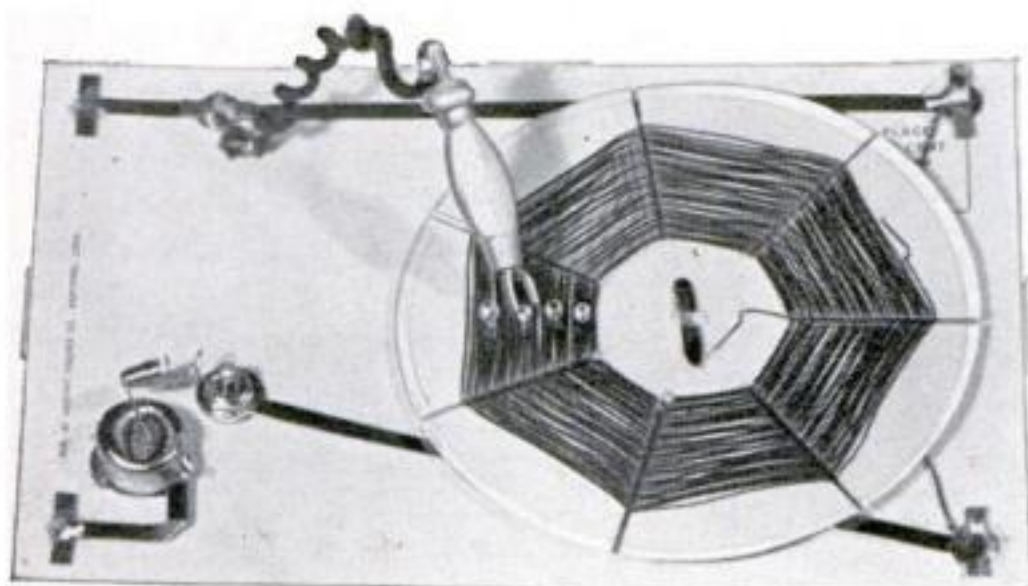
## CAN BE MAILED

HERE is a novelty radio receiver that you can slip into an ordinary envelope and mail to one of your radio-minded friends as an amusing birthday or holiday greeting. Mounted on a conventional scenic post card and covered with a second post card so that all wiring is concealed, the set consists of a simplified tuning coil and a crystal detector. With earphones clipped to two of its paper-fastener terminals and a ground and antenna attached to the two remaining terminals, the set is ready to bring in near-by broadcasting stations. Tuning is accomplished by fastening a small spring clip to the various taps on the homemade "spider-web" tuning coil, while a sensitive spot on the crystal can be found by shifting the cat whisker from one point to another until a station is heard in the earphones. The tuning coil is made by interlacing 100 turns of No. 30 double-cotton-covered wire around seven "spokes" cut in a  $3\frac{3}{4}$ " diameter cardboard disk, as shown in the drawing below. The coil should be tapped every twenty turns by removing the insulation and applying a blob of solder. The two post cards, which

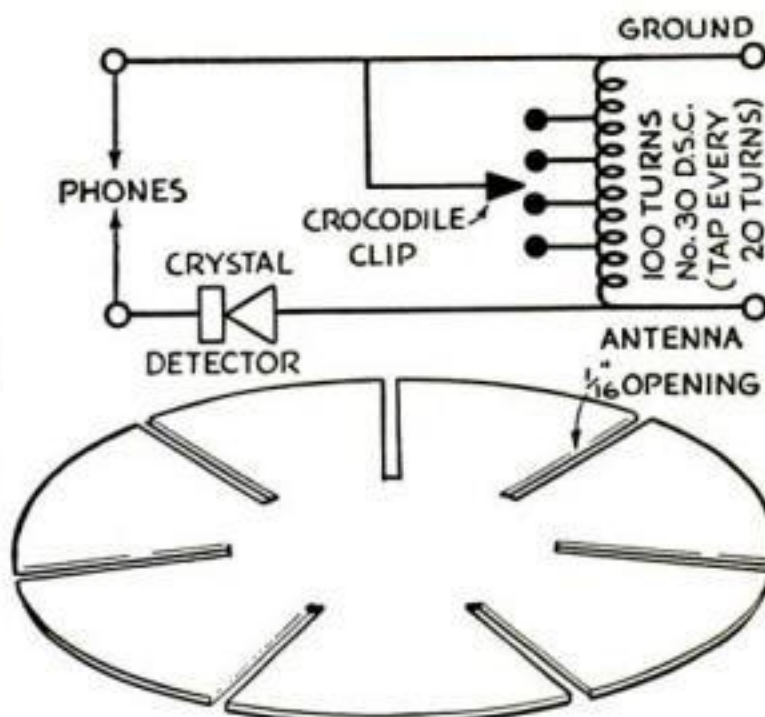


The letter radio can be mailed out of town for six cents. It is tuned by moving a spring clip from one coil tap to another

form the "chassis" and "cabinet" of the tiny receiver are held together by the paper-fastener terminals. To save space, flat copper ribbon was used in making the various connections.



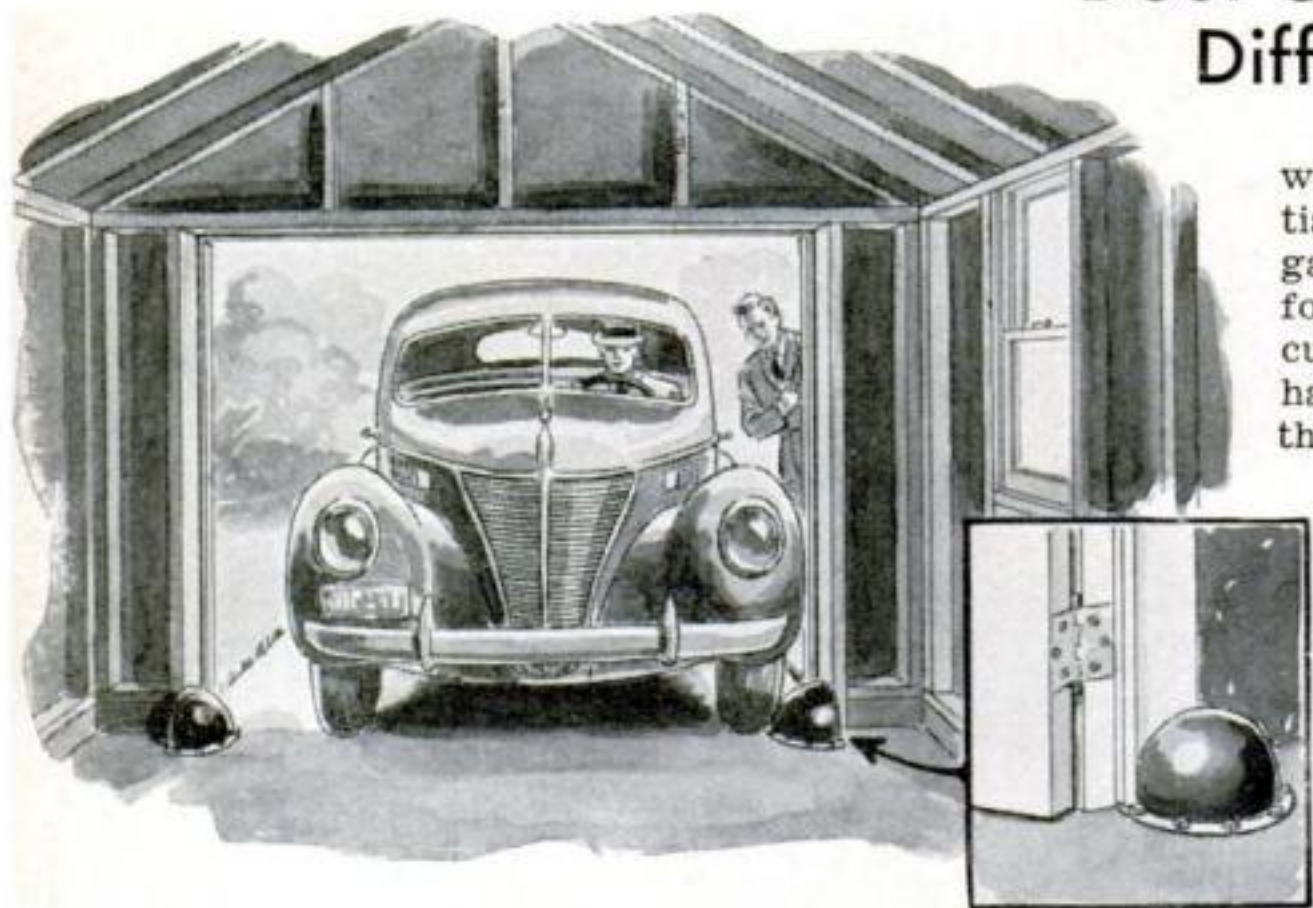
The tiny receiver with its post-card "cabinet" removed to show the wiring. Circuit and coil are shown at right





# Kinks for Car Owners

## Door Guards Made of Differential Cover



AN OLD differential cover will make a pair of substantial door guards for your garage. With a little effort, a good hack saw will cut the cover in half. The halves are then set against the insides of the door frame.

If the floor is of wood, fasten each cover down with wood screws through the bolt holes in the flange of the cover. If the flooring is cement, drill small holes and fasten the covers with expansion screws. The guards will crowd the wheels away from the door edge.—A. W.

These door bumpers protect your car's fenders as well as the garage doors

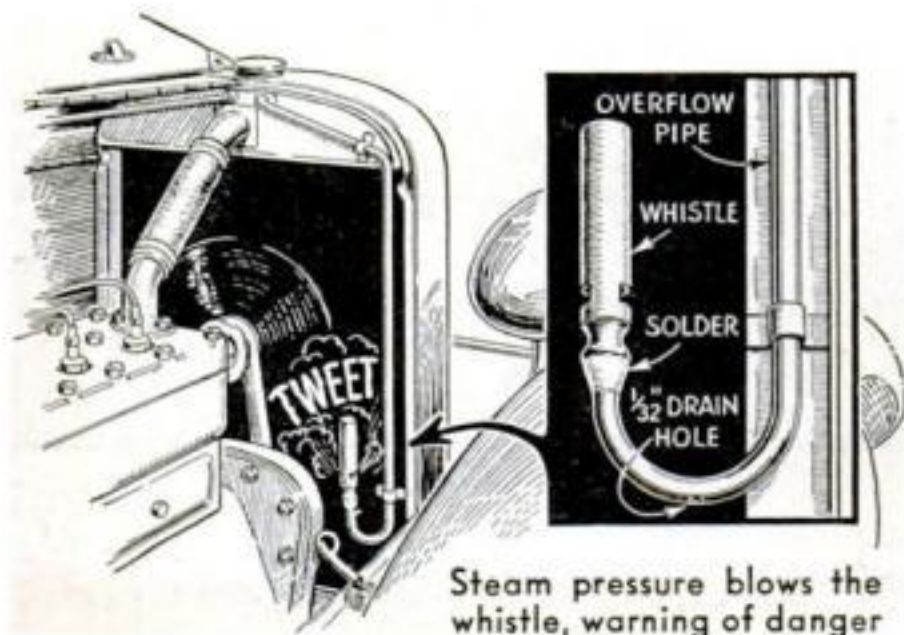
## Coil Spring on Wall Stud Holds Extension Cord

MOUNTED securely on a wall stud of your garage conveniently near an electric outlet, a coil spring properly stretched to leave small spaces between the coils makes a handy place to hang up the extension cord of your trouble light. Strong staples at each end of the spring will hold it taut. When through using your lamp, simply loop the cord back and forth between the coils as indicated in the drawing—H. W.



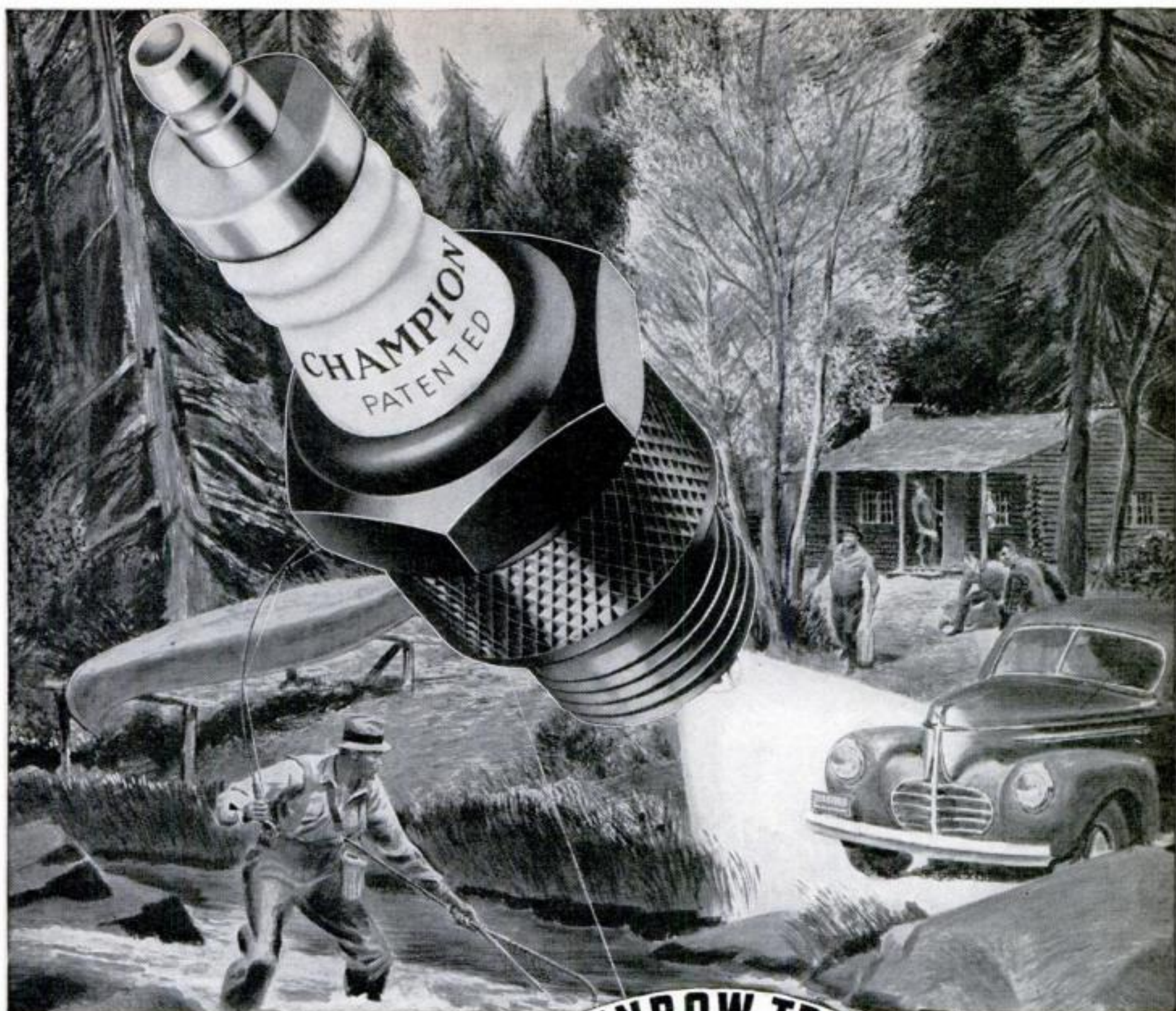
The cord is looped back and forth between the coils

## Whistle Blows If Radiator Boils Over



TAKING a tip from the "whistling-teakettle" idea, I rigged up a warning device on my car to tell me when the water in my engine starts to boil. Of course, I have a dashboard heat indicator, but too much reliance upon it once let me in for a costly repair job. Bending an inverted U in the lower end of the radiator-overflow pipe, I soldered a toy whistle to the upturned end. Now, if my car boils over on mountain roads, a shrill whistle gives me fair warning. A 1/32" hole in the bottom of the U lets any water overflow drain out, and is too small to allow enough steam to escape to prevent the whistle from doing its stuff.—J. E. H.





# PUT YOUR CAR ON THE RAINBOW TRAIL WITH NEW CHAMPION SPARK PLUGS

## MODEL BUILDERS—ATTENTION!

### ACTUAL SIZE V-PLUG



65c

Champion Spark Plugs for model gas engines give the same dependable performance as the regular Champions. Sillment sealed. Sillmanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION SPARK PLUG CO.  
901 Upton Ave. • Toledo, Ohio

YOU CAN chase rainbows—real or otherwise—to your heart's content with a car that's fit and ready to go—and there's nothing like a new set of Champion Spark Plugs to fit your car for any adventure.

Champions are more than ever today's spark plugs for today's high-compression engines, particularly because their exclusive Sillment seal prevents troublesome leakage common to ordinary spark plugs. Since even one "leaker" in a set will cause rough, uneven and wasteful engine operation, you appreciate how important this new development is.

This exclusive feature also makes each spark plug fire with absolute

uniformity in each cylinder by holding it rigidly within its heat range. Thus full, flowing power, speed and acceleration are kept at the maximum, while gas consumption is kept at the minimum.



*Studebakers equipped with Champion Spark Plugs won all places in the Sweepstakes Class of the Gilmore-Yosemite Economy Run. Champion-equipped cars won 7 of the 9 divisions.*

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

**"PICK UP AND GO" WITH NEW CHAMPIONS!**

MAY, 1940

Please mention POPULAR SCIENCE MONTHLY when writing to advertisers.

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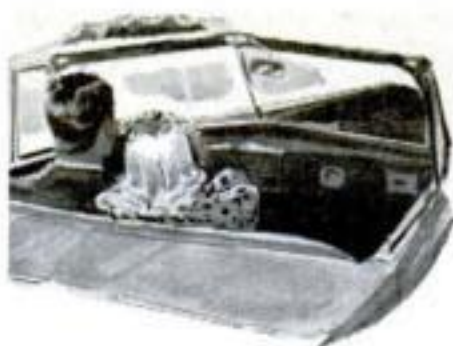


# "No," said Sally when I asked for a date

I guess I said things when Sally thumbs-downed a date. And she let fly—both barrels. "A little polish certainly wouldn't hurt your manners, Johnny Brown," she snapped. "Or your car, either," she added tartly.



**Burned?** I was so sizzling when I drove off I almost missed a miracle—Tub Smith actually polishing his car! "In love, eh?" I cracked. "No dame is worth the back-breaking job of car polishing." "Back-breaking?" Tub chuckled. "Listen, pal . . ."



"Try this Du Pont No. 7 Polish on your old ark," he said, "and see what 'easy' really means." Well, I did. In nothing flat, almost, my bus was positively dazzling! So dazzling that Sally, driving home from the movies, said dreamily, "Johnny, did you use that No. 7 on the moon, too? It seems extra bright tonight!"



## DU PONT No 7 POLISH

made by the makers  
of DUCO\* and DULUX\*

\* Reg. U. S. Pat. Off.

### WANT A SAMPLE?

DU PONT CO., Dept. 2-SP, Wilmington, Del.

Please send me a sample of the improved No. 7 Polish—enough for hood and fenders. I enclose 6¢ to help cover mailing costs.

Name \_\_\_\_\_

Address \_\_\_\_\_

City & State \_\_\_\_\_

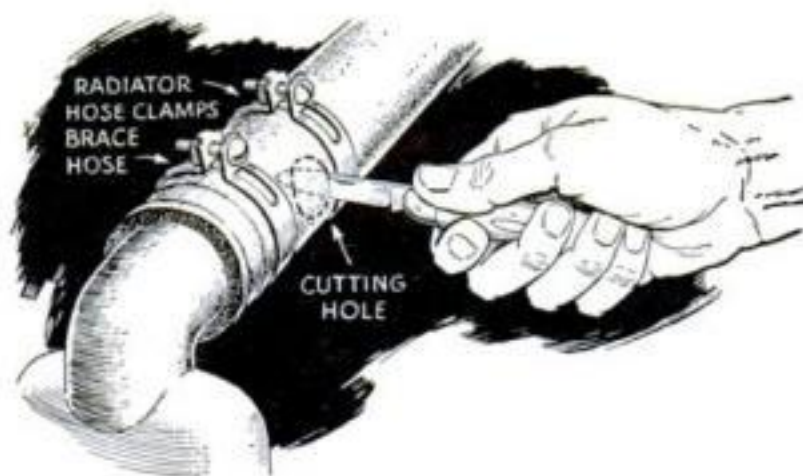
*Offer good in U. S. only*

**TAR AND ROAD OIL** can be removed quickly from car finish with DU PONT TAR REMOVER. It's safe!



## Automobile Coat Hanger Hooks Over Window

ANY piece of fairly stiff wire will do for making the handy coat hanger for an automobile, shown in use in the drawing, and detailed in the inset. Made in one piece by simply bending the wire as shown, the unit hangs over the top edge of a slightly lowered car window. Short sections of rubber tubing prevent the wire from rubbing against the glass of the window, preventing scratches and annoying rasping sounds as the car travels. Be sure to put the sections of tubing in place before the wire is shaped. A clamp wire is wrapped near the base of one of the hooks for strength.—B. K.



## Clamps Help Cut Holes in Radiator Hose

WHEN installing a hot-water-type heater in your car, it is difficult to cut a hole in the radiator hose without removing it and inserting a temporary wooden plug to keep it from collapsing while a drill is applied. To simplify the job, simply loosen the hose clamps already holding the hose in place and slide them close together on each side of the spot where the hole is to go. You will then be able to cut the hole with a sharp penknife, as the clamps will prevent the hose from collapsing even under pressure of the knife. Be sure to replace and retighten the clamps when the job is done.—G. E. H.





# Loafer makes good

## wakes up famous after long-distance snooze

*Long years of slumber  
in oaken casks works miracle of  
mellowness in BRIGGS Tobacco*

**D**OWNRIGHT laziness achieves fame and fortune for Briggs. Heedless of time, the best of each season's tobacco crop is tucked away by Briggs in fragrant oaken casks.

And while it dreams the slow seasons 'round, each golden leaf soaks up mellowness. All harshness and tongue-bite disappear. Only when Father Time has given his benediction does Briggs find its way into those mellow-hued tins that pipe smokers prize so much.

At your first pipe-puff, you'll discover how much extra smoking pleasure Briggs gives you—at 15¢ a tin. Try Briggs today and meet ... the "friend a feller needs",

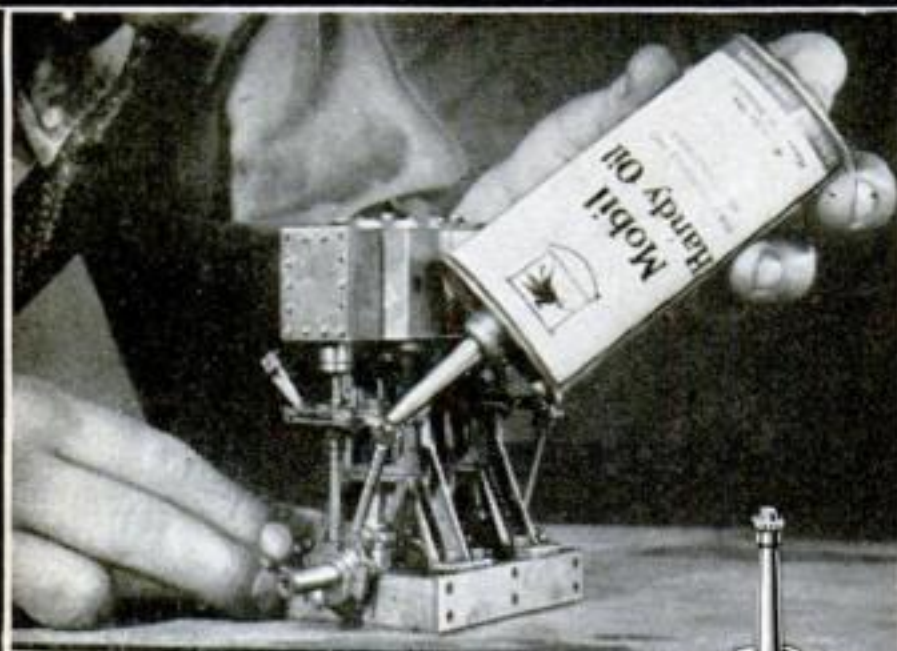
**CASK-MELLOWED**



*Extra Long for Extra Flavor*

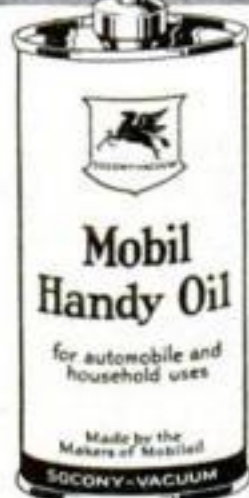


# KEEP TOOLS IN TRIM. MAKE MODELS RUN SMOOTH



## MOBIL HANDY OIL

This oil won't "gum up" your models. It's light—penetrating—lubricates household electrical appliances, sewing and washing machines, bicycles, toys. Fine for automobile generators, hinges, etc. Convenient wall bracket free with every can.



## SAVE ON REPAIRS Quiet Car Engine

### MOBIL UPPERLUBE

Add to your gasoline. It reaches the engine as a vapor. Its special impregnating ingredient protects upper cylinders, piston rings and valve stems from rust and wear.

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BY THE MAKERS OF MOBIL OIL

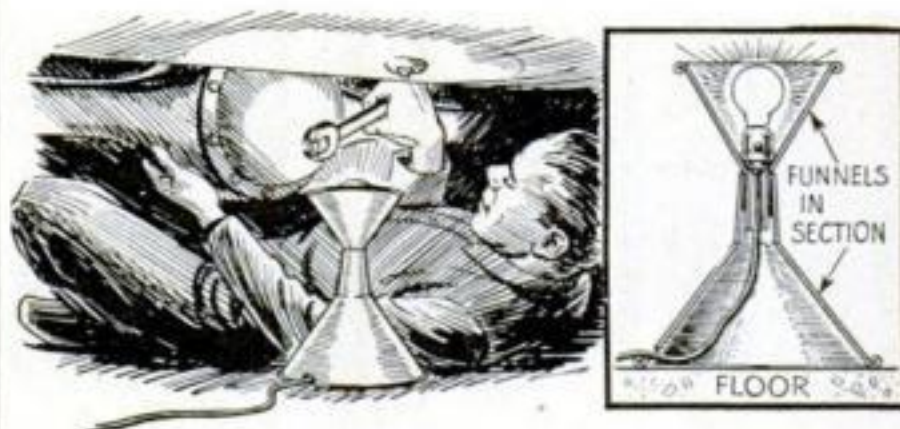
## Tool Removes Hub Caps Without Marring Them



A CONVENIENT tool for removing clamp-on hub caps without marring them can be made from strong steel wire shaped as shown with the hooked ends filed sharp. A screw driver is inserted through the looped end to act as a lever.—A. H. W.

## Funnels Make Lamp Stand

SERVING both to hold a service lamp and keep its light out of your eyes when working under a car, the two funnels shown in the accompanying sketch will be found useful in any garage. Disconnect the plug from your extension cord and slip the cord through the funnels as shown.—A. H.



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WHETHER you work in a garage or just like to tinker with your car, it's more than likely that you have figured out a novel way of doing various car jobs a little faster or better than usual. Other car owners would be interested in knowing about them, and POPULAR SCIENCE MONTHLY pays well for articles, illustrated with rough sketches or photographs, describing them in detail. Just write a clear description of your pet idea and send it along with illustrative material to the Automobile Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N. Y. If your article is accepted, a check will be mailed to you immediately.



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"LIGHTNING STREAKED across the sky ahead of us, as the car in which my baby and I were riding stalled on a desolate grade. Unable to start the motor, I let the car roll back into the center of a dry river bed.

"THE NEAREST RANCH WAS MILES AWAY. Helpless in the storm, we prepared for the long wait until morning. Then an ominous roar rose over the peals of thunder. I knew the sound. A mountainous torrent unleashed by a cloudburst, was hurtling toward us. I acted quickly.



"WITH THE BABY IN MY ARMS, and, aided by my flashlight, I scrambled through the boulders of the river bed to safety. Without that flashlight—and its dependable batteries—we would have perished. Thank you a thousand times for 'Eveready' fresh DATED batteries. They do not fail!

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The boat is 15' long, has a beam of 52", weighs 250 to 400 lb. depending upon the construction, carries six passengers, and costs between \$75 and \$100 with the motor. Blueprints (Nos. 384-385) are available for only 50 cents, and full-size patterns of frames, transom, and stem may be obtained for \$1.50 additional or a total of \$2.00. Blueprints are mailed at once, but patterns are drawn to order by the designer so about ten days must be allowed.

Plans are also available for other types of boats and for furniture, models, radios, and novelties. A partial list is given below. A complete list will be sent upon receipt of a self-addressed, stamped envelope. If you are interested only in boats, request our special illustrated boat list.

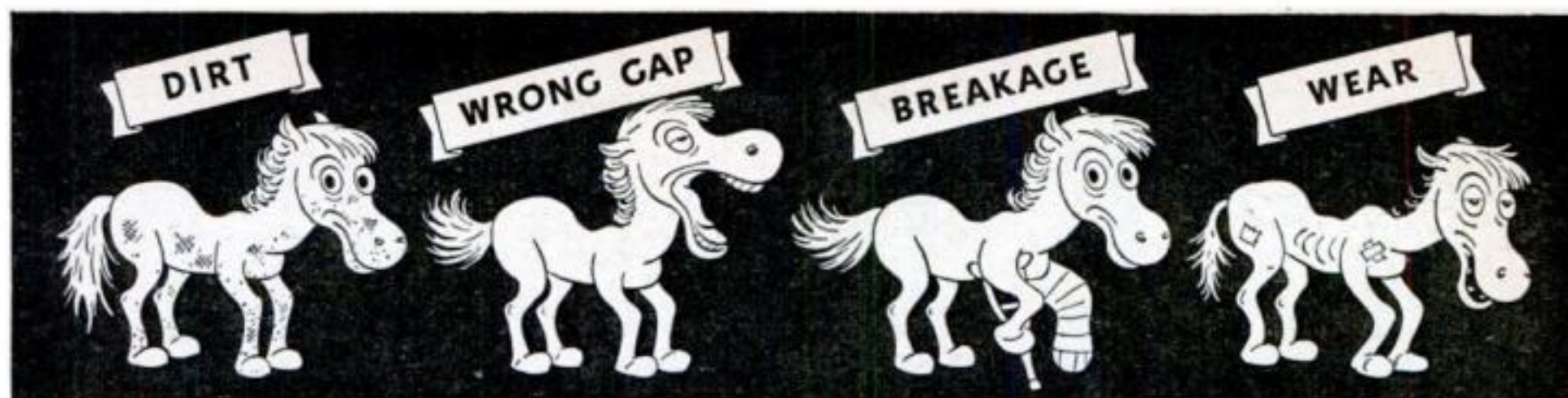


### BOATS

- Cabin Cruiser, 17' long, weighs 750 lb., for use with outboard or inboard drive, 356-357-358-359-R . . . \$1.50  
Folding Duck Boat, 13' long, 170-R . . . .50  
Family Runabout, 13' 5 1/2" long, weighs 275 lb., for outboards from 1 to 60 h.p.; can also be rowed, 378-379-380-R . . . .1.50  
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p., can also be rowed, 344-345-R . . . .75  
High-Speed Boat for Small Outboard Motors, 7' 11" long, 257-R . . . .50  
Inboard Boat, 15' long, weighs 325 lb., for motors from 1/2 to 5 h.p.; can also be rowed, 384-385 . . .50  
Midget Boat or Pram, 9' long, for oars, sail or outboard motor, 339-R . . . .50  
Motorboat-Rowboat, 13' long, with decked hull, for use with outboard or inboard drives, 147-R .50  
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R . . .1.00  
Sectional Rowboat, 9' 8" long; can be used with small outboard, 340-341-R . . . .75

(Continued on page 214)





# ONLY FOUR THINGS CAN HAPPEN TO ANY SPARK PLUG *and AC has the Cure for them all*

## DIRT

The most common cause of spark plug trouble. If the deposit is black, it's carbon or soot. If it's red, white,



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### The Cure

is a thorough cleaning (5c a plug) in the special machine developed by AC engineers. You will find this machine in service at more than 70,000 Registered AC Cleaning Stations. There's one near you. (Cleaning and regapping are needed every 4,000 miles.)

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Wear causes this condition. Sometimes, gaps widen too



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For normal wear—gap adjustment with the special AC tools used by Registered AC Cleaning Stations. Accuracy is assured by the special round wire gauge, which correctly measures concave gaps. *The cure for abnormal wear* is a new plug of correct type and temperature range. Better make it an AC.

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Breakage of the upper insulator is always the result of a blow, as when a wrench slips. A broken lower insulator results from an attempt to adjust the gap by bending the center wire; or from use of a plug which cools too slowly, or is of the wrong type.

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Spark Plug**

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### The Cure

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sink and  $\frac{5}{32}$ " Bit.

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Name.....

Address.....

P. S.

## Plans for Boat Builders

(Continued from page 212)

Skiff, 13' 9" long, 4' 7" beam, weight 225 lb., for 1 to 16 h.p. outboard motors; can be rowed, 363-R .....	.50
Sport Runabout, 9' 8" long, for small outboard motors, weighs 100 lb., 309-310-R.....	.75
Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R.....	.50



### MODELS

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Privateer SWALLOW, a Baltimore Clipper, 13" hull, 228-229-230-R .....	1.00
Racing Yacht, 20" Marconi-rigged sailing model, 48-R .....	.50
Spanish Treasure Galleon, 24" long, 46-47.....	.50
Trading Schooner, 17 $\frac{1}{2}$ " hull, 252-253.....	.50
U. S. Battleship TEXAS, 3' hull, 197-198-199-200..	1.00
Viking Ship, 20 $\frac{1}{2}$ " long, 61-62-R.....	.75

[Construction kits are available for some]  
of these models. Turn to page 216]



### FURNITURE

Colonial Writing Desk, 3' 6" high and 3' 8" long, 21.....	.25
Combination Bench and Tilt-Top Table, (no turning), 11.....	.25
Gate-Leg Table, 3' 6" diameter, circular top with leaves up (no turning), 24.....	.25
Modernistic Stand (24 $\frac{3}{8}$ " high) and Bookcase (70 $\frac{1}{2}$ " high), 88.....	.25
Sewing Cabinet of 1812, 178A.....	.50
Tavern Table and Scroll Mirror, 105.....	.25
Telephone Table and Stool, 18.....	.25
Tilt-Top Table, 20" by 24" top, 249A.....	.25



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Amplifier, Three Stage, 42.....	.25
Beginner's Battery Receiver, 365A.....	.25
Five Tube Short-Wave Set, midget receiver with loudspeaker, A.C. or D.C., 223.....	.25
One-Tube Receiver, battery operated, 103.....	.25
Screen Grid Receiver, 109.....	.25



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Electric Train, Horse, and Doll House, 14 .....	.25
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Perpetual Star Chart, 214.....	.25
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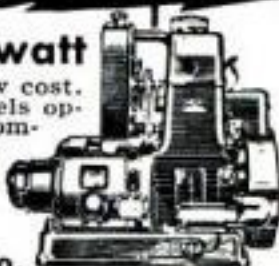
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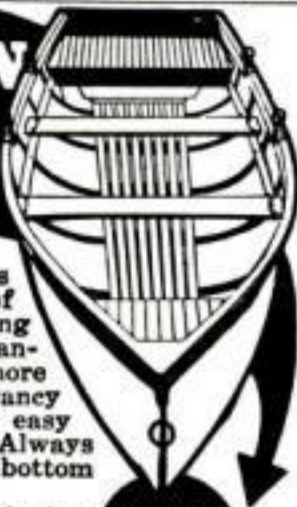
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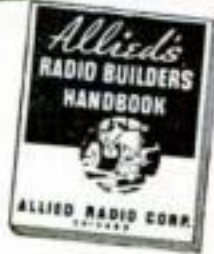
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(Continued on page 218)



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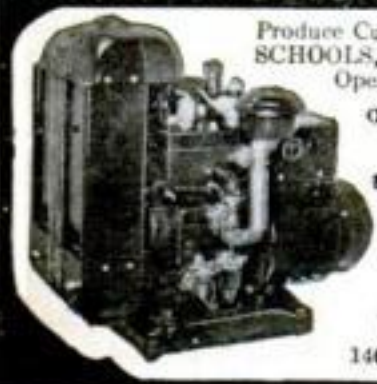


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Such a background may be a piece of plywood to which a stake is attached. Cover each side with a different shade of paper or cloth, one light and the other dark.

With light-colored blossoms, the contrast between the sunlit parts and the shaded petals, to say nothing of the foliage, is very great. This may be controlled by waiting for a slightly hazy sky, or the intensity of the light may be reduced by holding a screen of some thin fabric between the sun and the flower. The exposure-meter reading should be taken after the screen is in place. Usually this method is necessary only with a light-colored flower.—R. O. LISSAMAN.





## Cellulose Tape Removes Lint from Prints

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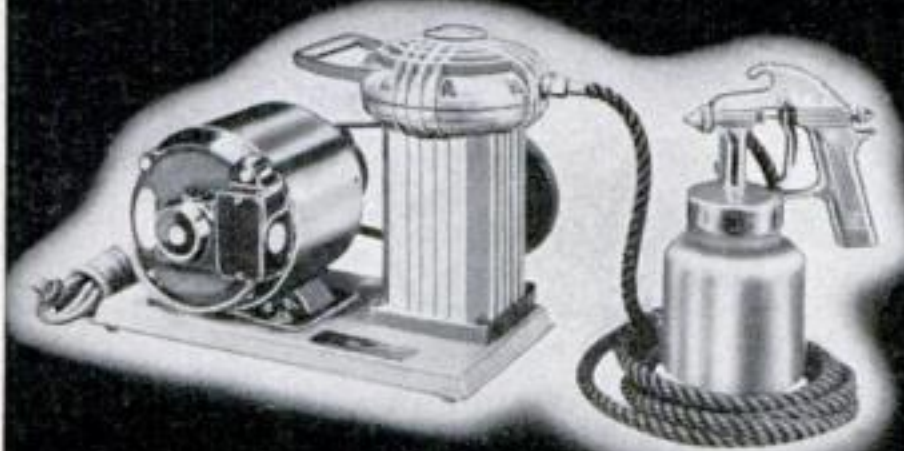
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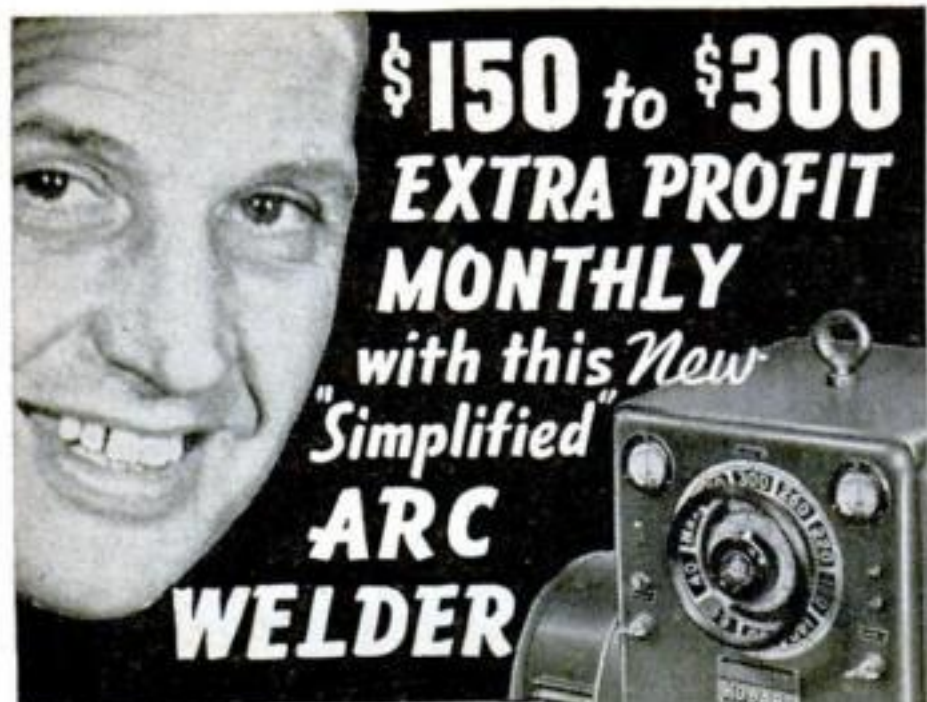
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**I**F YOU standardize on 12" hack-saw blades of the hand style and make a habit of using the forward 6" until worn, then the remainder of the blade, you will get much longer life out of each blade.

.....  
About six years ago I urged readers of this column to stone the ground edges of drills, milling cutters, reamers, and allied tools to extend the time between grinds. Modern machine shops now insist on this operation, only they call it "superfinishing."

.....  
To graduate accurately the side or circumference of a handwheel or similar part, fit the required lathe threading gear to a suitably made head center; fit an indexing screw to a member bolted to the bed of the lathe, and scribe with a sharp-pointed threading bit set in a tool holder and at right angles to the conventional position.

.....  
Some time ago we were amazed at the magnetic power of a new material lifting fifty times its own weight, but listen to this: The makers of that unusual alloy have recently developed what appears to be the maximum in this line, for the metal now lifts 1,500 times its weight.

.....  
One of our best-known drill chucks has recently been improved by localized surface hardening. Why not try this method with some of your work where solid hardening has caused distortion troubles.

.....  
I recently witnessed a fine job of boring in an internal grinding machine. The grinding head was designed for a quill, and it was necessary merely to replace the latter with a boring bar.

.....  
Contour sawing is certainly slashing costs of tool work in the modern machine shop. Although regular equipment runs into big money, I see no reason why many designers cannot use their heads and make reliable contour-sawing machines economically from band-saw tools.

.....  
The standard lubricant to thread, bore, ream, and broach nickel and its alloys is sulphurized oil. So-called "water-soluble oil" gives best results for cold sawing and grinding. These materials can be turned, planed, shaped, and milled either dry or with sulphurized oil.



## Giant "Atom Gun"

(Continued from page 51)

forms of matter. Everyone of the known chemical elements has been changed into from one to as many as eight new forms. Well-known substances like iron and oxygen may be produced in several totally different kinds. Already more than 300 substances never before known on earth have been created, and experimenters are busy investigating their unknown properties.

Most of these materials are radioactive—they lose no time in trying to get rid of the foreign particles that have been fired into them, and, in expelling them, duplicate the action of radium itself. Radio-iron, radio-phosphorus, radio-iodine—these are but a few of the unheard-of new products already being studied for their chemical and their medicinal applications. Some have a peculiar way of going straight to a certain part of the body—radio-phosphorus to the bones, radio-iodine to the thyroid gland—and so fire their tiny bullets at point-blank range, thus promising vast improvement in the treatment of certain diseases.

Power from the atom still remains an unrealized dream, but the making of unstable, radioactive substances is a first step in that direction. A gram of natural radium will boil its own weight in water every hour—and, at the end of 1,500 years, still will have half its original energy left. Imagine the power available if similar reactions could be started, then converted into chain reactions, each exploding the next, like a string of firecrackers!

Except in rare instances, atomic bullets fired from the present cyclotron only knock what might be called chips from the bombarded atoms. With bullets of 100,000,000 volts energy, atoms may be broken into many fragments. Such energies could be obtained with a giant cyclotron.

Strangely, water and paraffin are among the best insulators against the ray, and a forty-inch lead tank filled with paraffin acts as "backstop" behind the vacuum target chamber. A portable indicator carried about the laboratory in a small box measures the amount of the rays bouncing off solid objects. As a precaution against unnoticed reflections, every research man in the laboratory has periodic blood tests, to be sure he isn't getting an overdose of the rays. Lead-lined rubber gloves and tongs are used to handle the "artificial radium" after bombardment, and staff men are careful not to pick up barehanded any part of the target chamber or even the tools used in handling it.

## YOU'RE RIGHT— THE CONVERSATION'S ABOUT MEN



"YOU BIG PORCUPINE," I said to him. "What's the big idea not shaving off those bristles before coming to see me! Then he pulled that old gag about what two shaves a day does to a tender skin. And I said if he had any serious ideas about me, he'd better get wise to that old-fashioned skin torture he called shaving and get himself a nice, smooth Barbasol Face."

**CONTRARY AS A MULE**—guess that's why it took me so long to get around to Barbasol. But now that I look at the improvement in my skin—whether I use the razor once or twice a day—I can understand why they call it the quickest, easiest, smoothest shave a man ever had. (Your druggist has Barbasol in three sizes, 25¢, 50¢, 75¢. 5 Barbasol Blades, 15¢.)



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## Test-Tube Magic Creates Amazing New Flowers

(Continued from page 62)

which are composed of special drugs that speed up root growth; vitamin chemicals, permitting transplanting without the usual attendant shock; resins added to the soil to preserve humus from bacteria and thus increase the rate of plant growth—all these have played a part in recent advances. But most important of all has been the discovery of the magic effect of colchicine.

Before it is applied to the plant, this yellow powder is mixed with lanolin to produce a salve, or diluted in water for use as a spray or bath. Tiny amounts of the twenty-five-dollar-an-ounce drug are all that are required. In water, the proportions run one part colchicine to from 250 to 250,000 parts water. A mixture as weak as one part to 1,000 of water may prove too strong for some species, killing the plant. Every type of flower or vegetable appears to require a different concentration.

Various methods are employed in treating the plants. Perfume atomizers are sometimes used to spray the leaves. At other times, wicklike strings are employed to carry the colchicine to the plant stems. Again, the leaves are dipped directly in the fluid. When the lanolin-colchicine mixture is used, it is rubbed directly on the plant. Always, the first effect seems disastrous.

The plant becomes misshapen. Its leaves are distorted, roughened, and crumpled. Often they become thick and leathery. The explanation for these dramatic changes lies in the effect of the drug on the cells of the plant. Colchicine slows down the process of cell division. As a result each cell receives an increased number of chromosomes, those microscopic bodies that carry hereditary characteristics from one generation to the next. In general, an increase in the number of chromosomes means an increase in the size and hardness of the plant.

Consequently, scientists have sought artificial means of boosting the chromosome count in plants. This has been achieved by mangling the tips of branches in some plants, and in others by subjecting them to extremes of heat and cold. In recent years, bombarding seeds with X rays has proved effective.

Yet, of several known aids, in none has the laboratory horticulturist found as exciting possibilities as in colchicine. With its ability to create new species of plants, this yellow powder has dramatically enlarged the opportunities for bringing more valuable crops to farmer's fields and more beautiful flowers to back-yard gardens.



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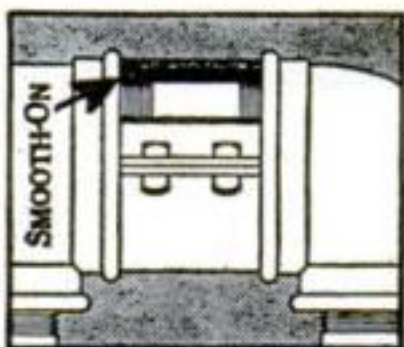
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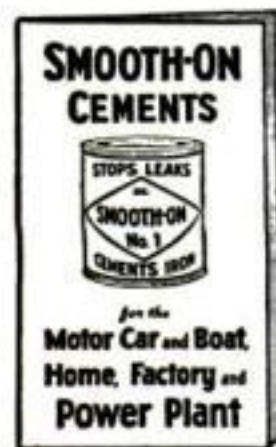
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# Fighting Movie Wars

(Continued from page 88)

twelve-inch intervals in a zigzag pattern.

An air mortar developed by Ponedel is the newest movie war-making machine. It consists of a storage tank for compressed air, an electrically operated release valve, and five air outlets. When the director calls for an explosion, Ponedel closes a switch, and compressed air forces a mixture of cork and earth upward with a swoosh to give a realistic explosion that is minus the danger of dynamite and powder.

Year after year, the same group of movie veterans fights Hollywood's wars. Today they may be British, French, or American troops. Tomorrow they change uniforms and become German, Turkish, Italian or Mexican fighters. Most of them have actually been under fire in Asia or Europe. They know how to relive the Hell of war—in the Argonne, at Gettysburg, or on Bunker Hill. They swing rifles and handle bayonets with calm assurance, and fall in the throes of agonizing deaths when the shooting starts.

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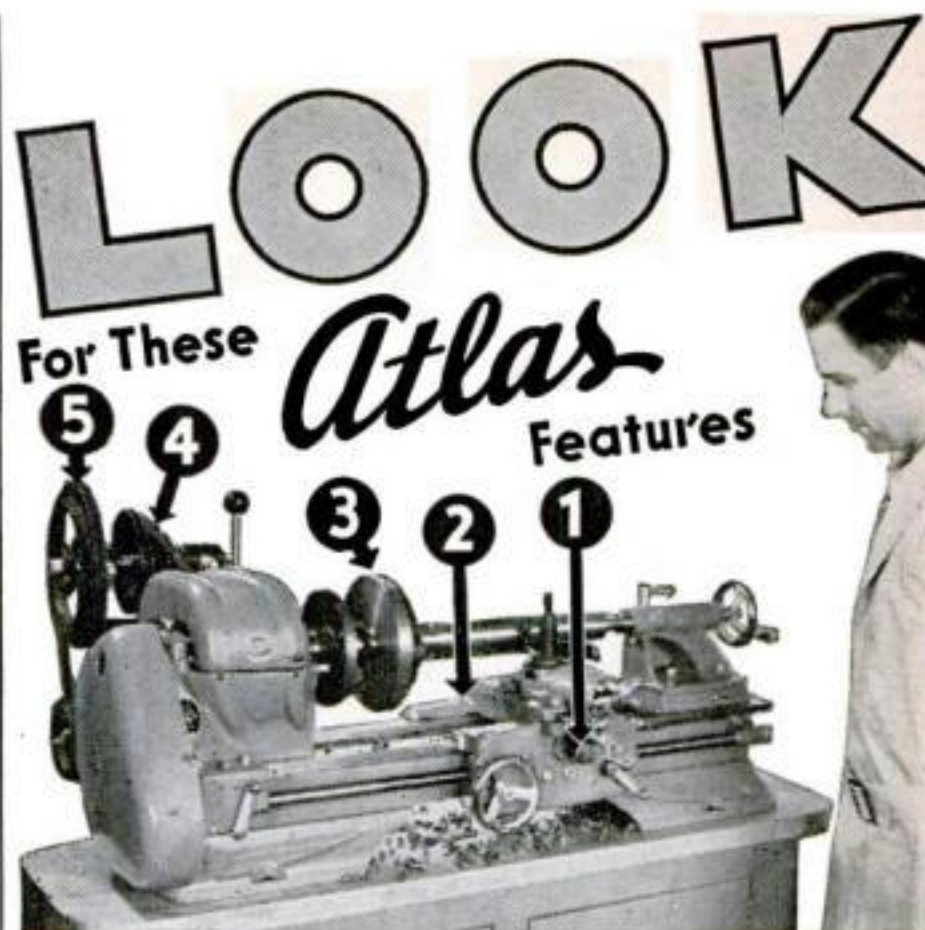
## POPULAR SCIENCE Question Bee

CHECK your answers in the Question Bee on page 124 against the list below. Give yourself five points for each one you had right. A total score of 75 to 85 is good; 90 or better is excellent.

1. b	5. c	9. c	13. c	17. d
2. d	6. c	10. c	14. b	18. c
3. b	7. b	11. a	15. c	19. c
4. a	8. c	12. b	16. a	20. b

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## Western Sheriffs Go Streamline

(Continued from page 115)

quarters. Teletype machines, hooked up in batteries, pound out messages throughout the day and night, exchanging information with police and sheriffs' departments a thousand miles distant, which may mean imprisonment for a criminal who little suspects the deputy riding near-by holds in his hand a complete record of his lawbreaking.

With two-way radio, instantaneous reports may be made of chases and captures. Not long ago an anonymous call tipped off headquarters that two burglars were robbing a building on a dark side road. The dispatcher called Car 251. As Deputy Walter Talmadge acknowledged the flash, Paul Chaillie stepped on the gas.

Fifteen minutes later, Chaillie spoke into the microphone: "Suspects ran into a corn patch." Another four minutes and, "Suspects left car. We're staking on car." Seven minutes later, "One returned and apprehended." Total time from call to arrest, twenty-six minutes. No old-time sheriff can tie that record.

Station KQBY can reach out to cars at all corners of the large county. Its signals are picked up by receivers built to withstand the constant pounding of twenty-four-hour service on washboard roads, of fast starts, hot chases, and quick stops. The car transmitters likewise are expected to operate at top efficiency, come what may.

Roy Thompson and Dick White took out after a stolen car late one evening. While zipping along a paved highway at a mile-a-minute clip, the car struck a double dip, careened against a power pole and turned turtle. White was pinned to the seat and Thompson was thrown clear of the wreckage. Painfully, Thompson crawled to the car, reached for the mike, and sent a message: "Car 223, calling Station A. Send ambulance immediately and notify power company lines down."

"Two thirds of his aerial was broken off, and his transmitter was upside down," Lt. Charles Ellison, sheriff's radio chief, told me later, "but that message boomed through just like nothing had happened."

Rescuing drowning persons, helping those stranded by storms, carrying information about troop movements, and directing marching soldiers through traffic-clogged streets . . . these are important duties. Of greater consequence, criminals in Southern California know that these radio-equipped deputies shoot with deadly accuracy.

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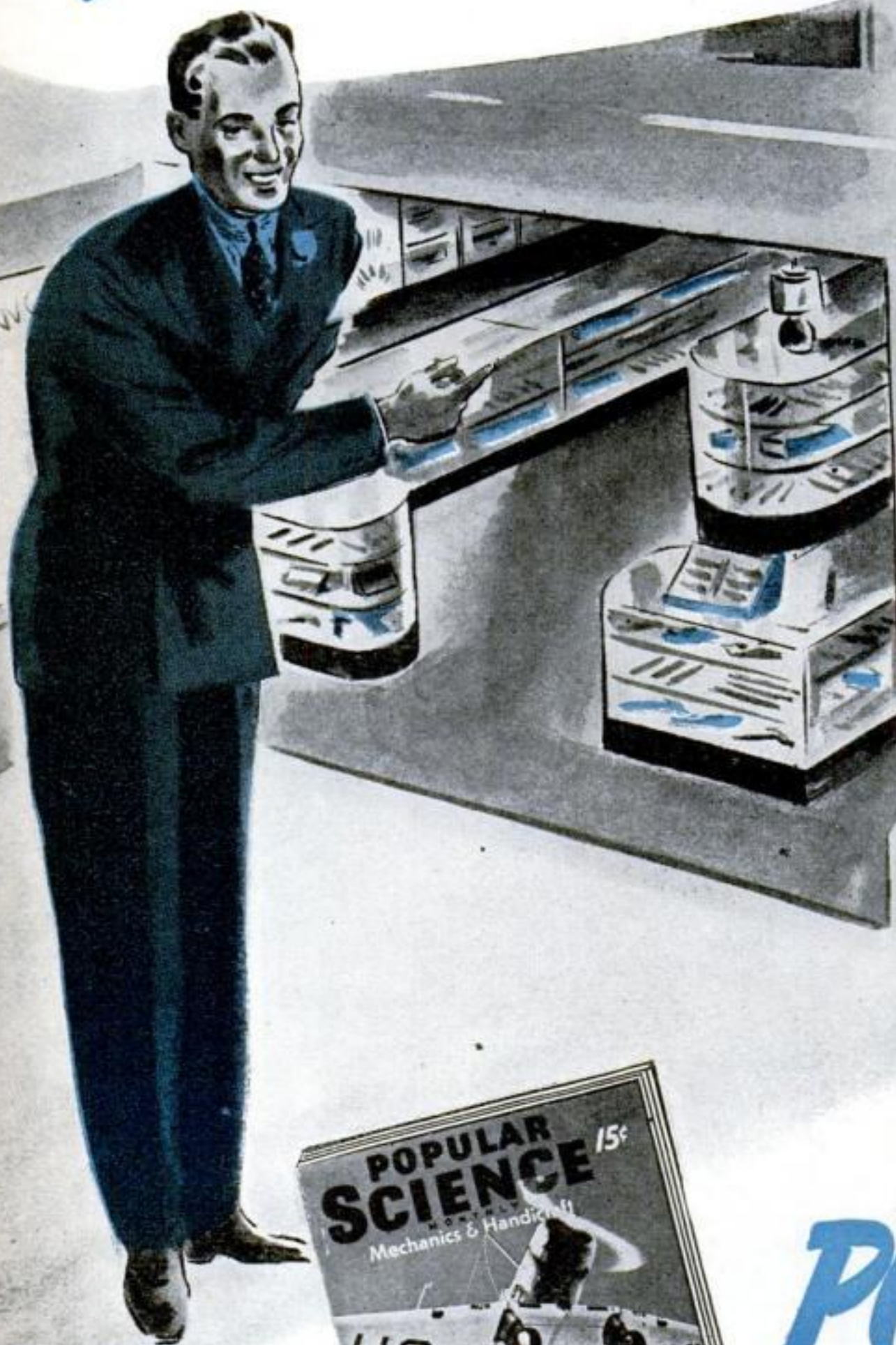
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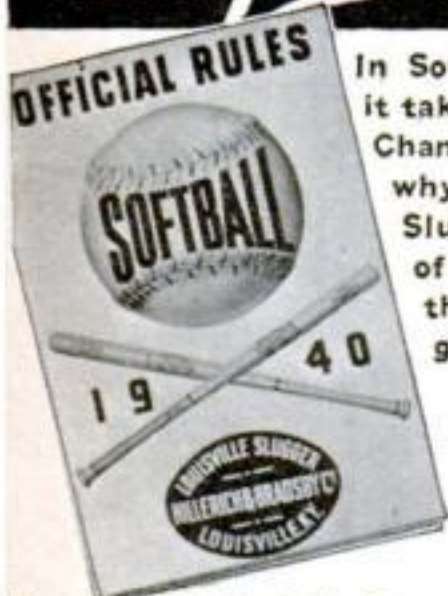


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## Why Car Fires Start

(Continued from page 128)

there is enough juice in the starting-motor circuit, and in the high-tension circuits between the coil and the distributor and between the distributor and the spark plugs to start a fire if you get a short circuit anywhere where conditions are right for a fire to start. If your car is *clean under the hood*, the worst that is likely to happen is a bad smell of burning insulation and the replacing of a couple of lengths of wire. But if the pans around your engine are covered with a half-inch-thick mess of grease, old oil, and gasoline which has spilled out of the carburetor, with maybe a couple of handfuls of oily waste stuck in it, any spark from a short circuit or from a back fire is likely to start a blaze.

"To keep your wiring system from going haywire, you should check it every couple of months," Gus advised. "If Mrs. Miller had had that done, her car wouldn't have caught fire. The wiring is too burned to spot just what caused the trouble, but it's a cinch that it was a short circuit. If the insulation of a wire looks—or feels—as if it is pretty well baked out, replace the wire with a new one. Give special attention to the insulation of the wiring between the battery and the starting motor—it has to carry the heaviest load. See that no wires can come into contact with any moving part. If the insulation of any wire is broken, or even slightly chafed, either replace the wire or wrap the chafed place with tape. But remember never to use friction tape on a high-tension wire—it won't insulate ignition current, and it won't hold if it gets a little greasy. Use linen tape and shellac it. See that all the connections are tight—that they are properly soldered and taped. And be sure to take an extra-careful look at the end of every stranded wire. See that the strands are twisted together and soldered."

"We get you, Gus," Knowles said. "Just make certain that the current in every circuit is guarded against leaking out, and you won't have any short circuits."

"That's the big idea," Gus said, reaching for his coat and hat. "If you don't have any short circuits, it is reasonably certain that you won't have any car fires—unless, of course, you're dumb enough to drop a lighted cigarette on your upholstery. The way cars are built today, fires are unnecessary. Most of the few we have aren't very serious—unless they are the result of a collision that breaks a gas tank—but some of them are expensive. Ask Henry Miller—after Joe sends in the bill!"



# Stunts with Calcium

(Continued from page 194)

amount of cold water, and the cellulose will precipitate out, in the form of fine white particles.

Another compound, calcium acetate, may be made from your precipitated chalk, or from your calcium carbonate "jelly." Transfer small portions with a celluloid spatula to a beaker containing warm acetic acid, of anywhere from twenty to fifty percent strength. Again, effervescence occurs as carbon dioxide gas is liberated. When no more calcium carbonate will dissolve, filter the solution and stopper it in a bottle. Do not attempt to crystallize the liquid, which might become coated with calcium carbonate by exposure to the carbon dioxide in the air.

If you heat solid precipitated chalk, it will decompose. Carbon dioxide gas will be liberated, and calcium oxide (unslaked lime) will remain. Add water to calcium oxide, and this chemical in turn is converted into calcium hydroxide (slaked lime). Dissolve the latter in water, and you will have what is known as limewater. But you will not be able to get much calcium hydroxide to dissolve. Even heat will not overcome its comparative insolubility. Both calcium hydroxide and calcium acetate differ from most chemicals in that less of them dissolves, instead of more, when the water in which they are placed is heated.

To show this, make saturated solutions of calcium hydroxide and of calcium acetate, using water at room temperature. Filter the solutions and place each one in a test tube fitted with a one-hole stopper, which carries a protruding piece of straight glass tubing six to ten inches long. Then heat each solution. In both cases, the liquid will turn white with crystals, thrown out of solution by the rise in temperature. The glass tubing serves as an air-cooled condenser, returning to the test tube any water that has been evaporated, so that the amount of solvent remains constant and the precipitation must be due solely to the change in temperature.

So that you can complete the gamut of changing familiar calcium compounds into one another and back again, here is the method of preparing calcium sulphate, which commonly goes by the name of gypsum. Simply mix a solution of any soluble calcium salt, such as calcium chloride or calcium nitrate, with a solution of any soluble sulphate. Calcium sulphate will then precipitate. Filter out the solid chemical, and wash it while it is on the filter paper.



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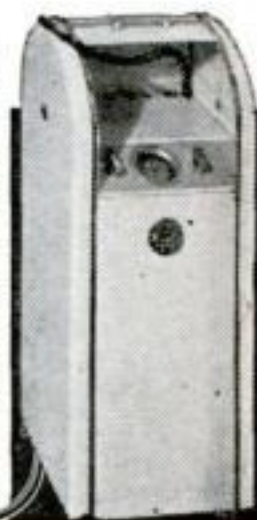
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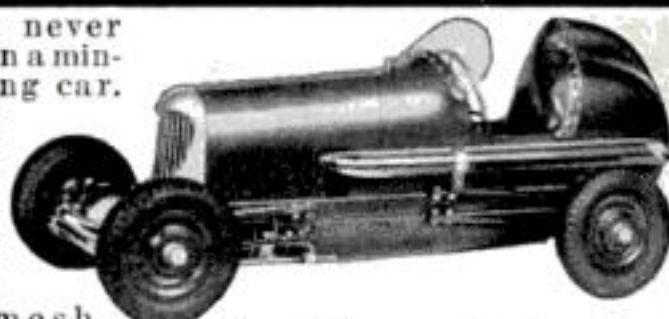


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## Your Microscope Reveals Bones in Sponges

*(Continued from page 197)*

and of the chitinous skeletons of sponges.

You can find fresh-water sponges growing around the stems of plants or hanging down from the bottoms of timbers that have been floating for a long time in water.

As for marine sponges of the commercial type, obtaining specimens of their skeletons is easy. You merely snip a small piece from a bath sponge, and look at it through your microscope. You will find that it is made up of a maze of horny stems connected to form a continuous network.

Marine sponges that produce limestone (calcareous) skeletons can be found along the beach, or their spicules separated from seashore sand. To collect the spicules for study, you must treat the sponge with potassium or sodium hydroxide (lye) solution to dissolve the fleshy parts. This is best done by putting the material into a strong caustic solution that has been heated. If necessary, heat further, until the sponge disintegrates.

Pour off the hot alkali carefully, and add fresh water to the residue. Let settle, and pour off again. Add more water and repeat until the collection of spicules has been thoroughly washed. (CAUTION: In handling hot caustic solution, keep it off the skin and clothing, and anything else it would damage.)

Fresh-water sponge skeletons are made of imperishable silica, and usually are separated out by putting the specimen into test-tubes containing strong nitric acid, and boiling over a gas or alcohol flame. When the sponge has disintegrated, the acid is set aside to cool and settle. It is then poured off, and the remaining residue of spicules washed as before. Sometimes nitric and hydrochloric acid are used together. (CAUTION: Handle strong acid with extreme care, and keep it off your clothing and skin. Be doubly careful when boiling it, and use only *small* quantities at one time. Perform the operations either outdoors, under a chemical hood that will carry away the fumes, or in some other place where ventilation is good and away from your face!)

Sponge spicules can be found in the debris on the bottom of bodies of water, and are often seen among diatoms and other objects obtained from sand. Sometimes no chemical treatment is needed to reveal them. They can be seen at 100 diameters, but to study them in detail you must use fairly high powers of your microscope, something around 300 to 500 diameters.



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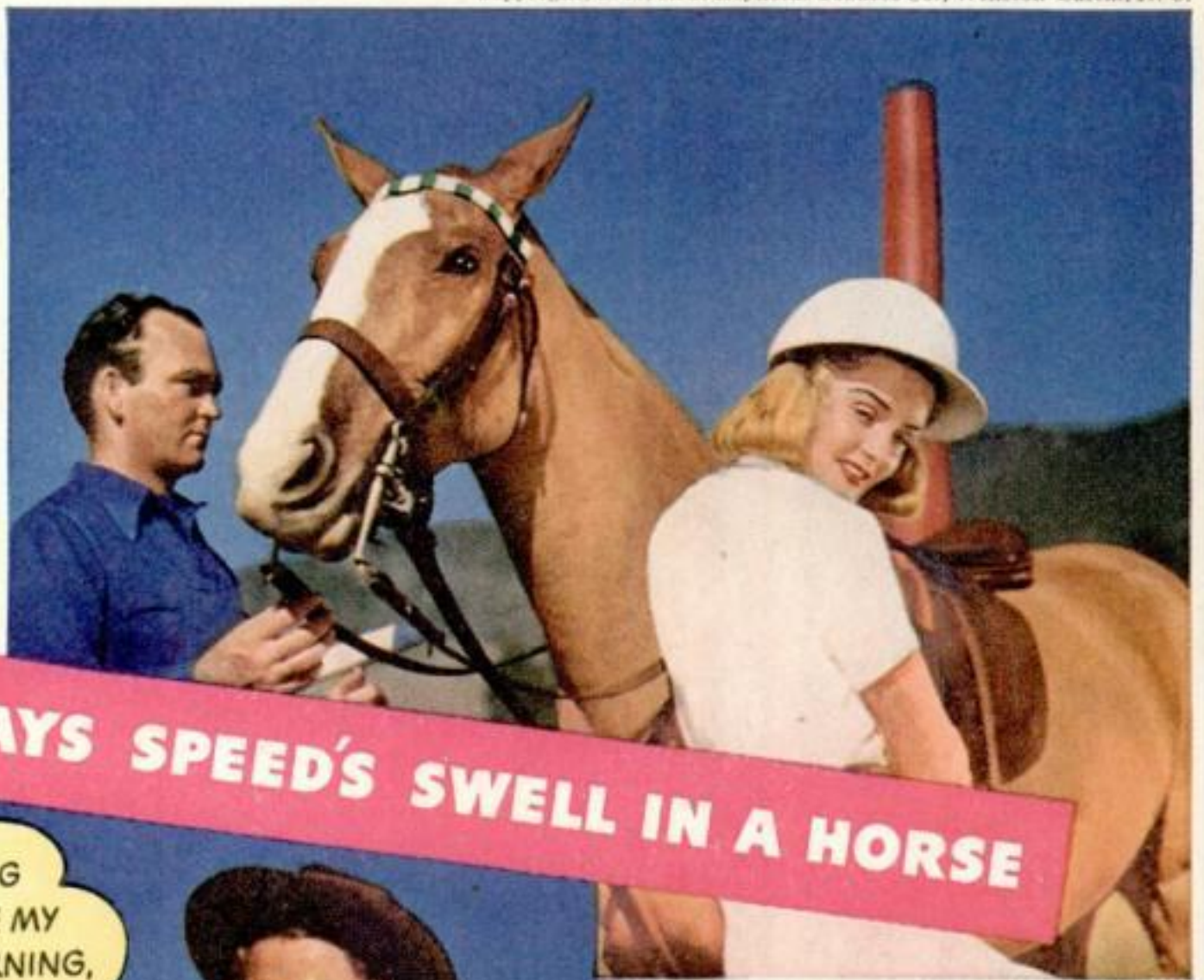


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...but the cigarette for her is slower-burning Camels because that means

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PEGGY McMANUS (*above*) studied ranch management. She's a swell dancer, swims, sails...is a crack rifle shot...handles her 16-gauge automatic shotgun like an expert. She picks Camels as the "all-'round" cigarette. "They're milder, cooler, and more fragrant," Peggy says. "By burning more slowly, Camels give me extra smokes. Penny for penny, Camels are certainly the best cigarette buy."

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**5  
EXTRA  
SMOKES  
PER  
PACK!**

NORTH, SOUTH, EAST, WEST—people feel the same way about Camel cigarettes as Peggy does. Camels went to the Antarctic with Admiral Byrd and the U. S. Antarctic expedition. Camel is Joe DiMaggio's cigarette. People like a cigarette that burns slowly. And they find the real *extras* in Camels—an extra amount of mildness, coolness, and flavor. For Camels are slower-burning. Some brands burn fast. Some burn more slowly. But it is a settled fact that Camels burn slower than any other brand tested (*see left*). Thus Camels give extra smoking...a *plus* equal, on the average, to five extra smokes per pack.

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